Paving and Municipal Engineering

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STREET-CLEANING IN GLASGOW.

THE streets of Glasgow are clean. They are quite as clean as those of any of the large cities of Europe. When I was crossing the Atlantic more than eighteen months ago, one of the passengers, a resident of that city, said: "In the morning the streets of Glasgow are as clean and white as this deck." I looked at the deck and thought of other streets not so clean.

The street-cleaning methods of that city are quite different from those of Paris. Paris has the advantage of a splendid system of sewers which Glasgow has not. The sewers of Paris empty into the river Seine or onto the sewer farms adjacent thereto, which latter are drained into that river. The sewers of Glasgow empty into the Clyde—a slow, sluggish stream, with an artificial channel which requires constant dredging to keep it open. It is close to the sea, and is greatly affected by the tide water. Street dirt emptied into it from the sewers would soon fill it up. Of course, the gutters drain into the sewers and the sewers into the river. But everything in the way of street dirt and refuse is gathered up, put into wagons and hauled away. In Paris, this street dirt is washed into the sewers. The conditions are favorable to this system in Paris, and unfavorable to it in Glasgow. Hence, there is a distinct difference in the methods of handling street accumulations in the two cities.

Street-cleaning is modern work in Glasgow. The necessity for clean streets was emphasized by a knowledge of their dreadful condition. It is not many years since Glasgow was a very dirty city. Out of this dreadful state it has grown to be a very clean one.

It was pleasant to talk with members of the town council and others directly interested, and see that they are not satisfied as to results. They do not say in effect: "See the greatness of all that we have done;" on the contrary, they state: "We are far from doing what we wish to do. Come and see us again in a few years,

and you will find great improvements." One member of the town council said to me: "I am quite disheartened at the work there is ahead of us. True, we have done a great deal, yet so much remains to be done that it is quite disturbing to contemplate it." This is a splendid spirit; it is the spirit that makes clean streets, and keeps them clean; it is the spirit that develops a high order of sanitation; one that protects the people, and leads them in the direction of more comfortable living.

I said to an official in the street-cleaning deparment: "Tell me something about your methods."

"O," said he, "the method is simple enough, but it is the carrying of it out that you must consider. You see street-cleaning is very simple work. You must know that in the houses and yards, in the stores and courts, as well as in the streets, is originating dirt, garbage and refuse. As far as the street is concerned, it is a mere matter of sweeping and gathering up. As for the garbage and other offal, it must be placed in proper receptacles so that we may carry it off. This is the rough outline of the plan, but there are many cities and towns which have this same plan and do not carry it out. The result you know—dirty, muddy streets, filthy courts and yards, disease-breeding houses and a general pestilential condition. That is the state in which Glasgow used to be. Edinburgh was quite as bad, and, of course, you have heard of London and its plagues. You see you have got not only to have a plan of street and city cleaning, but more than all, it has to be well carried out. No plan is a good plan if it is not pursued with intelligence and diligence."

I said to my acquaintance that I wanted to look into the operation of street-cleaning in his city. He told me that I would have to do most of my work at night, and so I did.

The organization for thoroughly sweeping and cleaning all streets, alleys, sidewalks, and the removal of all of the offal from all buildings, yards and courts is one which I shall hope to present in such definite shape that it may be adapted to any city or town in America. The work in Glasgow is more largely manual than it need be with us, though for thoroughness, carefulness and constancy we need not expect to do any better.

All of the rubbish, garbage and manure is taken to cleansing

stations. There are three of these establishments in Glasgow. I went to one of them at twelve o'clock at night when the carts were beginning to come in. As they enter the gate they pass over scales and are weighed. This weighing of the cart, the record of its number, and the time of its arrival does several things: it determines whether the wagon is over or underloaded, and whether its trips are made at proper intervals.

From the scales the wagons pass up an inclined plane to the upper floor of the cleansing works, which is a large brick structure. We will say that one of these wagons contains the refuse from ash bins which takes not only the ashes from the galvanized iron buckets and barrels, but also the kitchen and house rubbish and the general offal from housekeeping. This load is dumped to the floor near an opening which leads to a large revolving screen. This screen is a good deal like a large bolting reel in a mill, or an immense revolving coffee roaster. It is made of metal, and has holes in it about an inch and a half in diameter. The material from the wagon is pushed into this revolving screen, and the dust and ashes sift through the holes. This dust and ashes fall down to an inclined board shown in Fig. 1. Of course it immediately begins to slide off. In this process a very peculiar and interesting separation is made. Mixed with this dust and ashes are lumps of coal and cinder. They are naturally heavier than the smaller particles, and slide down the incline with more force. The result is that they pass over and beyond the board lettered *B* on the drawing, while the dust and ashes fall into the hopper lettered *H*. From this very simple device the city of Glasgow gets enough coal to much more than supply steam and heat for its cleansing works. This is no inconsiderable amount, considering that three hundred tons of material are handled in this one house every night. The ashes in the hopper are mixed with street manure and the product of vault cleaning, and run into car on the tracks at the bottom of the cleansing works. It is sold as manure. A hundred thousand dollars' worth of manure from this source was sold during the year 1890.

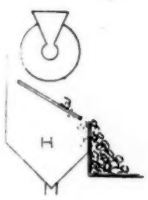


FIG. 1

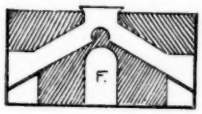


FIG. 2

This part of the description accounts for what goes through the holes in the screen. It does not account for what passes over it—glass, bottles, tin cans, rags and junk, straw, and the nameless rubbish which comes from the great cities. All this falls from the end of the screen or bolting device, which I have described, to a drag belt which carries this rubbish away from the screen. One or two men stand alongside of this belt and remove the valuable junk, such as bottles, metal, bones and tin cans. The bones are sold as manure, the bottles and metal as junk, and the cans have the tin and solder melted off them, which have their own particular value. The rubbish is pushed from the drag to the tops of furnaces, and from thence into the furnaces themselves.

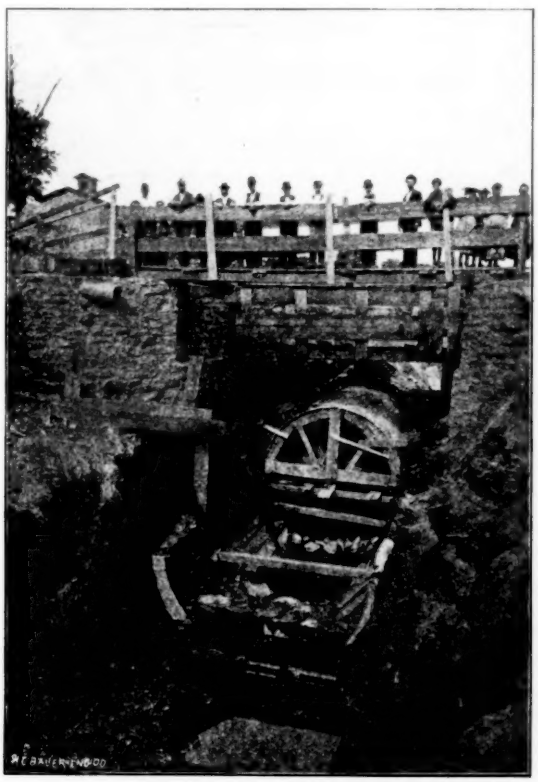
Figure 2 shows a section of one of these furnaces. The rubbish is fed in at the top and slides down to the grate bars near the bottom. The heat of the fire kindled below, and as well the heat of the brick work generated from the previous firing, dries out the rubbish above, no matter how wet it may be. Thus it is readily consumed. If it is quite wet when first put in, it is left there a few hours and is dried out by the remaining heat in the brick work. These furnaces are sometimes used in garbage furnaces. The heat goes down through the flue marked *F* and out through a stack. In the Glasgow works the revolving screen and the receptacles which receive the products of the vault cleaning are ventilated by having the air about them drawn through the furnace and into the flue. These cleansing stations are located in populous districts, and by being ventilated in this way they are not, in any sense, offensive. The stack rises something over two hundred feet above the immediate surroundings. The cinders from this burning are used for filling and concrete work, and the ashes are sold as fertilizer. As said above, one hundred thousand dollars was realized from the sale of manure during the year 1890. This was quite an off-set against a cost of four hundred thousand dollars for city cleaning. Thus three hundred thousand was the net cost. Certainly for a city of eight hundred thousand inhabitants, this was not excessive.

LOUIS H. GIBSON.
Biographical Sketch in January Number, 1893, page 15.

Louis H. Gibson.

A NOTABLE SEWER.

THE Mill creek sewer of Philadelphia—of which the accompanying photograph represents a section under Fifty-fourth street bridge at Jones & Udell's mill—was commenced about twenty-four years ago, but not worked on continuously since that time; during the last three years about a mile of it has been built, and it is now rapidly approaching completion. The total area drained by the Mill creek sewer amounts to 4,600 acres. The capacity of this sewer at the outlet is 5,033 cubic feet per second. The total length of sewer constructed is about four miles. The diameter decreases gradually from the outlet to the inlet or termination at the city line; the sizes are 20 feet diameter, 18 feet 6 inches, 17 feet 6 inches, 15 feet, 14 feet, 12 feet and 9 feet 6 inches. When photographed — on June 4th, 1893—it was in the 12 feet diameter section where the top of the sewer is about on a level with the bed of the creek.



It has been completed, or is under construction from the Schuylkill river through West Philadelphia to the city line, except for a short distance between Lancaster avenue and Pennsylvania railroad on the line of Mill creek. The total cost of the work has been about $900,000.

From an approximate estimate taken from the sections and from the length of the sewer, about 30,000,000 bricks have been used in its construction.

W. WAPLINGTON, Biographical Sketch in May Number, 1893, page 256.

This is the main trunk into which is conducted the bulk of the drainage from the built-up portion of the city, west of the Schuylkill river.

For the above statistics I am indebted to the courtesy of James H. Windrim, Esq., director, department of public works and Geo. S. Webster, Esq., chief engineer. *Wm. Waplington.*

THE USE OF SILICA GRAVEL IN CONCRETE.

THE use of hydraulic concrete for all kinds of construction, sea-walls, and pavements has become so general that the quality of the materials of which it is made is an item of great interest to engineers, contractors and tax-payers. Engineers in making specifications in most instances call for broken stone, to the exclusion of other materials—gravel, etc., and I find that many persons who have not given the question proper consideration, entertain the theory that concrete made of broken stone alone is a superior mixture and should only be used.

Whenever my opinion has been asked as to the advisability of allowing gravel or pebbles to be substituted in whole or in part, I have invariably answered that if they were clean, hard and of proper size, they would make equally as good, if not better, concrete than broken stone.

To procure good results in concrete it is essential that the sand, broken stone or gravel should be of a silicious composition, clean, hard, free of clay, organic matter or other impurities. As much care should be taken in the selection of sand and gravel as in that of cement.

The theory that the irregular faces and sharp edges of broken stone contribute to the adhesion of the mortar with which they are mixed is incorrect, and this has been demonstrated by practical experience.

It is a well known fact that hydraulic cement shows greater ad-

hesion to clean silica gravel than to broken limestone, and therefore produces better results in concrete.

Silica and silicates with hydraulic limes or cements make concrete or artificial stone of a superior quality, on account of their mutual chemical affinity. The sea gravel generally used in the vicinity of New York in making concrete, béton, etc., has this advantage, that while it can be had in uniform sizes it is irregular in shape and packs solid.

ANALYSIS OF GRAVEL FROM NORTH SHORE OF LONG ISLAND.

No. 1.

Silica	94.73%
Oxide of Iron	1.38%
Alumina	2.80%
Lime	0.59%
Magnesia	0.17%
Phosphorus	0.04%
Sulphur	0.29%

ANALYSIS OF GRAVEL FROM NORTH SHORE OF LONG ISLAND.

No. 2.

Silica	80.720%
Oxide of Iron	5.380%
Alumina	8.730%
Lime	1.990%
Magnesia	1.010%
Phosphorus	0.074%
Sulphur	0.260%
Loss on Ignition	0.980%
Manganese	Trace
Undetermined	0.826%

Gravel concrete has been used with great success in the construction of some of the largest works in New York and vicinity, principally in the foundation of the Race Rock Light-house, the largest single mass of concrete known to be placed under light-house construction. Gravel concrete was also used exclusively in the foundations of both towers of the New York and Brooklyn Bridge, about eight thousand tons of concrete filling being used in the New York caisson alone. The load carried by each square foot of this foundation was over seven tons. It was completed in 1872, and there has been no appreciable settlement since. This concrete was made of one part Rosendale cement, two parts sand and four of

beach gravel, all by measurement. The eminent engineer, C. C. Martin, C. E., was the chief engineer and superintendent of the New York and Brooklyn Bridge, this concrete having been made and put in place under his supervision.

Gravel concrete was also used some twenty years ago in the reservoir in Prospect Park, built by the same engineer, Mr. Martin, and holding twelve feet of water. It was made, bottom and sides, of gravel concrete with Rosendale cement, and is in perfect condition to-day.

RACE ROCK LIGHT.

In answer to an inquiry as to his experience in the use of gravel for concrete, the well known engineer and contractor, F. Hopkinson Smith, Ass. M. Soc. C. E., wrote under date of December 15, 1892, as follows:

In 1871 I was awarded the contract by the United States Lighthouse Establishment for the construction of the Race Rock Lighthouse, situated in Long Island Sound, two miles from the westerly end of Fisher's Island. The problems to be solved were the construction of a foundation capable not only of bearing the weight of the superstructure and resisting ordinary wave action, but also of withstanding the thrust caused by the immense fields of floating ice flowing out of the Connecticut river, with a normal velocity of six miles an hour—the only obstacle in the way being this light-house. The force of this pressure may be estimated by imagining a situation with the thermometer at zero, the wind forty miles an hour blowing with the tide and the ice twelve inches thick. As a matter of fact, this has occurred several times since the light has been built, the ice piling upon the structure in a mass thirty feet high.

To meet these problems successfully, an artificial island was constructed in the form of an ellipse, one hundred and seventy-five feet by one hundred and twenty-five. The interior of this island was then excavated, leaving a circle with a diameter of about one hundred feet, in which was placed four iron bands, of an aggregate height of twelve feet, filled with concrete mixed as follows: One part English Portland cement, two parts sand, three parts screened gravel, and three parts broken stone (trap), making, by measure, one cubic yard of mixed concrete to the barrel of cement of four hundred pounds. The mass, when placed, was twelve feet thick, sixty-nine feet in diameter on the bottom and fifty-seven feet on top, and contained twenty-nine thousand cubic feet of concrete. Upon this was built a masonry pier in the form of a frustum of a cone, faced and backed solid with Cape Ann granite, fifty-four feet in diameter and

twenty-eight feet high, upon which was placed a two-story dwelling of granite, the whole superstructure weighing about five thousand tons.

All of the concrete in this mass was mixed on the site in a horizontal concrete mixer, driven by a small portable engine, the product being then run into iron valve buckets, holding one cubic yard each, which were then lowered under and through the water and dumped so as to form a continuous mass. Only salt water was used. When the last and top band was filled (it came just to mean low-water mark), the whole surface was leveled off and cement mortar floated so as to make it level.

Recent inspection of this work, made under the special supervision of my superintendent, Captain Thomas A. Scott, who personally conducted much of the diving operations at the site, shows that this mass of concrete is absolutely intact; not the slightest abrasion occurs even around the outside edge, while no part of the masonry shows the slightest deterioration, the mortar joints still remaining unbroken, showing that no settling had been possible.

In answer to your inquiry as to my own experience and practice in mixing large masses of concrete, I have to say that I have always advised the use of gravel, to be used in equal parts with broken stone.

First—Because its rounded surfaces pack more closely in the interstices of the broken stone, and

Second—Because there is no possibility of "arching," which sometimes occurs with the exclusive use of broken stone, even when the presumption is that the concrete has been properly rammed.

Within two years past the United States Light-house Establishment accepted my suggestion to incorporate gravel with the broken stone in the foundation of a light-house constructed by me for them in Cold Spring Harbor, Long Island Sound, as being preferable, although the specifications indicated all broken stone. This light-house, however, was much smaller in dimensions than the Race Rock structure, requiring only about five hundred yards of concrete to fill the iron caisson.

Very respectfully, your obedient servant,

F. Hopkinson Smith,

Ass. M. Soc. C. E.

Mr. Smith's views as to the value of pebbles in making concrete are in conformity with the practice of the Lighthouse Department, as shown in the following specifications of a sea-wall constructed by his firm under a contract with the Lighthouse Board.

"Specifications for sea-wall concrete at Staten Island for the Lighthouse Board, contract dated June, 1888.

"One part Portland cement, two parts sharp sand, three parts pebbles, four parts broken stone, not larger than will pass through a two-inch ring."

And in the extension of the same wall, as is shown by the following extract from specifications for foundation for sea-wall at Staten Island, by Major D. P. Heap, U. S. Eng., November 28, 1892:

After the coffer dam has been completed, the mud and soil must be pumped out to hard bottom and then be covered with two layers of concrete in bags (the bags to be sewed so as to leave no fag ends), and the coffer dam then filled with concrete to five and one-half feet below mean low water, and the last layer of concrete allowed to set for twenty-four hours. The concrete must be composed of one part Portland cement of acceptable quality, two parts clean, sharp sand, three parts of pebbles and four parts broken stone not larger than will pass through a two-inch ring.

FORTY-SECOND STREET RESERVOIR.

The following facts in reference to the old Croton Aqueduct, and the reservoir at Forty-second street and Fifth avenue, furnished by Mr. James Symington, are of interest in this connection, and are further evidence of the value of pebbles in the making of concrete:

The original specifications of 1838, for the construction of the Croton Aqueduct, gate-houses and distributing reservoirs are signed by John B. Jervis, Chief Engineer, and are now filed in the office of the Chief Engineer of the Department of Public Works, New York City.

They require for concrete, "that hydraulic lime and sand shall be mixed with water to the consistency of thin mortar and into this shall be incorporated broken stone three-quarters to an inch and a half in diameter or gravel and pebbles not exceeding one inch in diameter, in such proportions as shall be determined by the engineer."

The custom of the engineer of the Croton Aqueduct has been to use for concrete either broken stone or gravel, as might be most convenient at the location where the work was being done, and such is the rule at the present time, gravel concrete being considered equal to that made from broken stone. There seems to be no official record of the proportions, but the present distinguished Chief Engineer, George W. Birdsall, C. E., states that the custom of his office has been to use one part cement, two parts sand and three parts gravel or stone, making a concrete which is practically watertight. In the construction of the distributing reservoir at Forty-second street, New York City, gravel was principally used, because

it could be delivered cheaply at that site from the north shore of Long Island. The concrete in the old Croton Aqueduct is also largely composed of gravel or pebbles, and its solidity is not exceeded by any work in the world, it having stood the test of pressure and time. The part of the old aqueduct south of the Harlem river, when removed, showed the pebble concrete to equal solid rock in density and hardness, and the part still standing near One Hundred and Seventh street bears mute witness to the knowledge and fidelity of the engineers under whose direction it was constructed.

The specification for the new Croton Dam now under contract requires that "the concrete shall be formed of sound broken stone or gravel not exceeding two inches at their greatest diameter. All stone in any way larger is to be thrown out. The materials to be cleaned from dirt and dust before being used; to be mixed in the proportion of four parts stone to one part cement." The proportion of sand in the mortar is left to the discretion of the engineer.

The eminent veteran architect, Mr. James Renwick, under whose design the distributing reservoir at Forty-second street was constructed, and who is to-day the only survivor of the band under whose direction this great public work was carried out, has kindly consented to make public a statement as follows:

"The composition and materials used in the construction of the foundation of the distributing reservoir of the Croton Aqueduct, which was built under my supervision, I beg leave to state, was composed of one part of Rosendale cement, three parts of clean, sharp sand, and four parts of gravel from the north shore of Long Island, which was nearly pure white quartz of size not exceeding one inch in diameter. (Signed) JAMES RENWICK."

The distributing reservoir has twelve inches of concrete over the whole bottom covering the puddle, and holds twenty million gallons of water with a depth of thirty-six feet.

JAMES SYMINGTON.

This is additional evidence that clean, hard silica gravel or pebbles make concrete, having all the qualities of density, tensile and crushing strength.

I am confident that it will be conceded that small stones with rounded surfaces can be readily and uniformly mixed, and produce a concrete of greater strength and solidity than where the stone have irregular faces and sharp edges, as is the case in what is known as broken stone.

Charles H. Haswell, M. Am. Soc. C. E., Ins'n C. E., says: "The irregular faces and sharp edges of broken stone are not ele-

ments of advantage in the composition of either concrete or béton, as they in no wise contribute to the adhesion of the lime or cement with which they are mixed."

Making concrete with hydraulic lime or cement will not give good results unless there is an affinity with the sand, broken stone or pebbles used, which I will illustrate by an extract from my report made to the government of District of Columbia, in 1886, on the "Sand Test."

SAND TEST.

Extract from Report of the Operations of the Engineer Department of the District of Columbia for the fiscal year ending June 30, 1886 (fol. 57):

Hydraulic cement, though tested neat, is hardly, if ever, used in that condition, but is mixed with sand to make mortar for the construction of walls, etc., or mixed with broken stone, etc., to make concrete. As matter of fact, a hydraulic cement which shows great tensible strength, will generally have great power of adhesion if fairly employed.

The desirability of ascertaining the adhesive power of a cement has led to what is known as the sand test. It is done by gauging cement with sand in certain fixed proportions and testing the briquettes, made in the ordinary manner, for tensile strength. But it is essential, in order to obtain satisfactory results, that the sand should have the required physical and chemical qualities.

I have seen sands, though clean and sifted through the same sieves, and not unlike under the microscope, give results that differed greatly when used with the same cements. This led me to investigate the causes of the different results apparently obtained under similar conditions.

In Germany the government sells a standard sand, to all who require it, at a moderate price. Here the contractors must obtain their sand where and how they can, to be accepted by the government under certain specifications.

Two very essential points in selecting sand for making mortar should be observed:

First. That the sand be of a free silicious nature without the admixture of carbonaceous sand or clay. Silica and silicates have great affinity for hydraulic cements and produce great adhesive power, while carbonates, such as carbonates of lime, etc., have much less, and give poor results. In a clear washed sand containing 20 per cent. of carbonaceous sand used with hydraulic cement, the tensil strength was reduced 30 per cent. After having been

treated with hydrochloric acid and washed in order to eliminate the carbonates from the sand, its initiative adhesive power was restored. Thus, in selecting sand, a sample ought to be treated with hydrochloric acid, and if any effervescence is perceptible, it is an indication that it contains carbonates, and the sand should, therefore, be rejected.

Second. The voids of the sand must be ascertained by first drying the sand and then filling a given measure with it well packed and filling the voids with water, the quantity of the water used will be equal to the voids in the sand. The quantity of the hydraulic cement employed with sand to make mortar which will give excellent results should be equal to the volume of voids, plus 2 per cent.

The sand generally employed in the District of Columbia has voids from 31 to 32 per cent. The specifications for mortar are two parts of sand with one part of cement equals 33⅓ per cent. of hydraulic cement. By these proportions the voids are well filled and the results obtained are very satisfactory.

I would therefore recommend that it is important that the percentage of cement used in mortar with sand should be at least equal to the percentage of voids in the sand.

A sand having 40 per cent. of voids was mixed with 33⅓ per cent. of hydraulic cement, and the average tensile strength of this (10 briquettes) was 15.50 pounds per square inch after ten days, while the hydraulic cement of the same barrel mixed in the same proportions, two of sand to one of cement, the sand having only 32 per cent. of voids, gave in ten days an average tensile strength per square inch (10 briquettes) of sixty-two pounds.

The importance of a sand test can not be denied, and is, as we have seen, indispensable. A great deal has been written on this subject without giving much information, but in reality it is a simple matter. To test the cement with a standard sand is out of the question. The sand to be tested is the sand to be used which, combined with the tests of the hydraulic cements to be employed, will give the necessary information as to the ultimate strength of the structure.

Very respectfully submitted,

E. J. De Smedt,
Chemist, District of Columbia, General Inspector
of Asphalt Pavements and Hydraulic Cement.

Col. William Ludlow,
Engineer Commissioner.

My experiments and observations made since that report was submitted, confirms the theory then stated—that hydraulic cements have great affinity for silicates and silica, and I can also state that what was there reported in reference to the smaller grains of silica

(sand) apply with equal force to the larger pieces of silica—as pebbles or gravel, and that silica stones with rounded edges and smooth surfaces will make better concrete or béton than broken limestone with sharp edges and of angular forms.

I wish to be understood that sand or pebbles should be clean and thoroughly washed, such as that taken from below the water-line on our sea coast. *E. J. De Smedt.*

SOUTHAMPTON SEWAGE PRECIPITATION WORKS AND REFUSE DESTRUCTOR.

[The Southampton refuse destructor described in the following article by M. Bennett, the borough engineer and surveyor of that city, is regarded as the best in England. The system of sewerage in Southampton is similar to that in American cities.]

EARLY in 1885 the corporation of Southampton considered it expedient to introduce a more efficient system for the collection and disposal of house refuse; and about the same time they found it desirable also to clarify by precipitation the sewage of a particular district of the town, which was being discharged in its crude state direct into the Southampton water at the town quay. Having been instructed to devise a scheme for accomplishing these objects, the author proposed the adoption of a refuse destructor for destroying the ash-bin contents and garbage of the town, and also that the sewage sludge should be transmitted to the destructor from the two existing reservoirs in which it was deposited in the process of clarification. These reservoirs are each one hundred feet long and sixty feet wide and at the lowest end ten feet deep. Formerly, the sewage of a district of the town amounting to 500,000 gallons in twenty-four hours from a population of about 13,000, for the most part flowed by gravitation into these reservoirs, whence it was discharged into the tideway at low water; while a small portion, coming from a low-level sewer, passed direct into the tideway through iron pipes laid under the reservoirs. The reservoirs act alternately, one being left still for precipitation of the sewage while the other is being filled.

PNEUMATIC EJECTORS.

In order to render independent of the tide, the discharge of

the clarified effluent from the reservoirs, and to raise the low-level sewage into the reservoirs for treatment with the rest, two pneumatic ejectors were erected, both of which are worked by power obtained from the destructor. The smaller, of 360 gallons' capacity, is placed in the east reservoir, below the invert of the low-level sewer, and serves for transmitting the sludge from the reservoirs to the destructor, as well as for raising the low-level sewage; and the larger, of 700 gallons' capacity, is placed in the east reservoir for discharging the clarified effluent into the Southampton water. There is also a third ejector, of 360 gallons' capacity, which deals with the sewage of another district of the town near the destructor works, and is likewise worked by power obtained from the destructor; with an air-pressure of twelve pounds per square inch it raises the sewage about eighteen feet from a low-level sewer to a higher one. This ejector was formerly worked by an independent steam engine, costing for coal £120 per annum, which is now saved since the adoption of the destructor.

The sewage gravitates from the sewers, through the inlet pipe, into the ejector, and gradually rises therein until it reaches the underside of the bell. The air at atmospheric pressure inside this bell is thus inclosed; and the sewage continuing to rise outside above the rim of the bell compresses the inclosed air sufficiently to lift the bell, the spindle of which then opens the compressed-air admission valve. The compressed air thus automatically admitted into the ejector presses on the surface of the sewage, driving the whole of the contents before it through the bell-mouthed opening at the bottom and through the outlet pipe into the iron rising main or into the high-level gravitating sewer, as the case may be. The sewage can escape from the ejector by the outlet pipe only, because the instant the air pressure is admitted upon the surface of the sewage the non-return flap valve on the inlet pipe falls on its seat and prevents the sewage from escaping in that direction. As the sewage flows out of the ejector, its level therein falls to that of the cup; and still continuing to lower, it leaves the cup full until the weight of the stuff in the portion of the cup thus exposed and unsupported by the surrounding sewage is sufficient to pull down the bell and spindle, thereby shutting off the admission of compressed air to the ejector. The compressed air remaining within the ejector then ex-

hausts through an air-escape valve in the top, which is opened by the fall of the cup and spindle; and the sewage outlet non-return flap valve falls on its seat, retaining the sewage in the rising main. The sewage then flows once more into the ejector through the inlet, driving the free air before it through the air-escape valve as the sewage rises; and so the action goes on as long as there is sewage to flow. The position of the bell and cup floats is so adjusted that the compressed air is not admitted until the ejector is full of sewage, and is not allowed to exhaust until the ejector is emptied down to the discharge level.

RESERVOIRS.

In each reservoir there is a floating sewage inlet, consisting of a pipe hinged to the larger or effluent ejector and shackled to a buoy; the latter causes the free end of the pipe to rise and fall with the level of the liquid, keeping its mouth, which is covered with perforated plate, a few inches below the surface of the liquid, in order to prevent the entrance of any floating solid matter. Directly the clarification by precipitation has been effected to a certain depth, a valve is opened, admitting the liquid into the larger ejector, whence it is at once discharged into the tideway. A supplementary sewage outlet is also provided in each reservoir for discharging the liquid by gravitation when the tide is low enough. When the whole of the liquid has been thus drawn off, the buoy, resting now upon the floor of the reservoir, keeps the mouth of the inlet pipe high enough to prevent the entrance of any sludge into the larger or effluent ejector; and by opening a valve the sludge is then admitted into the smaller or sludge ejector situated at the lower level and is transmitted by air pressure through a line of 4-inch cast-iron pipes, about a mile in length, to the destructor erected on the Chapel Wharf. An air pressure of 40 pounds per square inch is required for working the sludge ejector and of 10 pounds for the effluent ejector.

PRECIPITATION.

Ferrozone is used for precipitating the sludge; it is mixed with just enough clean water to make the whole into a stiff paste, which is led through a shoot into a box with perforated sides placed in the sewer. The sewage flowing past washes the ferrozone gradually out of the box, and is thoroughly mixed with it by the time it discharges

into the reservoirs at a manhole 150 feet distant from the box. A small stream of water falling upon the ferrozone prevents it from consolidating. The box is filled three times in twenty-four hours, and this method of dosing the sewage has proved quite efficient and satisfactory.

MANURE-MIXING.

On arriving at the destructor the sludge is delivered into a cell, from which it is drawn as required through a valve pipe; and after mixture with road sweepings or sorted house refuse, it is turned out as a good manure, which from the commencement has all been readily bought up by agriculturists at 2*s*. per load delivered at the works. On an average 67 cart loads of ash-bin contents are daily collected and disposed of, the ascertained weight of the load in each cart averaging a little under 17 cwt. The road sweepings are never burnt; but, to keep pace with the demand, the sludge is run into bays made of the road sweepings, and is also filled in with them. The quantity of road sweepings thus utilized amounts in twenty-four hours to about eight tons. Arrangements were provided at first for burning the sludge, for which purpose it was discharged into a tank on the floor of the destructor and drawn out through ports in the front, opposite the feed openings of the firing chambers, where its moisture was absorbed by the ash-bin contents, which were backed up against the ports with this object; and the mixture was then raked into the fires. Large quantities of sludge were thus destroyed; but the process has since been discontinued, owing to the ready sale of sludge when prepared for manure.

DESTRUCTOR.

The refuse destructor has six chambers or furnaces, each capable of burning 8 to 11 tons of garbage per day. The products of combustion pass through a 30-horse-power multitubular steel boiler in the main flue into a furnace shaft, which is of circular brickwork, 160 feet in height from the ground line, 6 feet inside diameter at top, and 7 feet at bottom. The shaft is constructed upon a pedestal 14½ feet square and 24 feet high, of brickwork 3 feet thick; and thence upward in four sections, of which the first is 27 inches thick and 30 feet high, the second 22½ inches thick and 30 feet high, the third 18 inches thick and 38 feet high, and the fourth 14 inches thick and

38 feet high. The first 30 feet [of this shaft] is lined with fire brick, and behind the lining is a cavity 4½ inches wide, which is ventilated by apertures to the outside of the shaft. The foundation is loamy clay, upon which is laid a bed of concrete 30 feet square and 10 feet thick. The footings commence at 23 feet 2 inches square, and step off in regular courses upwards to 15 feet square at a height of 6 feet. The concrete was filled in continuously until completion. The pedestal was then run up and allowed to remain for nearly three months during the winter, after which the work was proceeded with until completion, occupying about six months more. The cap is white brick in cement, with a string course about 20 feet below the top. Foot irons are built inside in a winding lead up to the top. The shaft is provided with a copper-tape lightning conductor, with iron rod and crow's-foot 7 feet above the cap; the tape is about 215 feet long, the bottom end being carried into a well. In August, 1888, the shaft was damaged by lightning, but was easily repaired, owing to the provision of the foot irons built inside it. At that time the shaft was plumbed, and was found to be quite vertical. The fires were only damped down during the repairs, which occupied about eight days. With the exception of this interval they have been constantly burning for nearly six years. The repairs have been almost nil. There is also a by-pass from the destructor to the shaft for enabling the burning process to be continued when the boiler in the main flue is not required or during cleaning and repairs. No obnoxious fumes from the combustion have been perceived.

STEAM POWER.

The steam generated in the boileris employed for driving a pair of engines of 31½ indicated horse-power, which compress air into two large receivers at Chapel Wharf, whence it passes through a 5-inch main to the town quay, where it is automatically supplied to the ejectors when required for working them. The air also serves for driving the precipitated sludge through the 4-inch main from the reservoirs to the destructor, for which purpose the air is led by a pipe from the receiver at Chapel Wharf to the head of the main at the town quay. A 6-horse-power engine, used in connection with the machinery for the preparation of fodder for forty horses at the cor-

poration stables, is also driven by steam from the same boiler that supplies the air-compressing engines.

UTILIZATION OF SLUDGE AND REFUSE.

All obnoxious matters are collected throughout the borough in covered iron tumbler-carts of two cubic yards' capacity, which go up the inclined roadway approach to the destructor and discharge their contents into the firing chambers. The road sweepings are frequently discharged into a hopper over an incorporator driven by a small engine, and are mixed with the sludge as required; this is generally done in wet weather. The residue from the continuous day and night combustion consists of about 20 per cent. of good, hard clinkers and sharp, fine ashes. The clinkers are used for the foundation of roadways and the manufacture of paving slabs; the latter have already been used in paving several footpaths of the town and the new public baths at a cost of 2*s*. 6*d*. per square yard. The fine ashes are also employed for making mortar, with which the stables and swimming baths have been erected, and for many other purposes. The mortar is also sold to builders at 7*s*. 6*d*. per cubic yard.

ELECTRIC LIGHTING.

The waste heat from the destructor is utilized for producing electricity. The air-compressing engines drive a dynamo of 150 volts. At the present time, the works are lighted with two arc lamps of 3,000 candle power each and twelve incandescent lamps of 16-candle power each; and four streets in the vicinity of the works have been lighted experimentally for the information of the corporation, which, from the successful results obtained, resolved to extend the installation to the municipal offices, a town clock, the Hartly Institution, and the town hall at the Bar Gate. For this purpose it was proposed to place accumulators in the basement of the municipal building and charge them through a cable from the works. Circumstances having led to the abandonment of the street lighting, the public became financially the losers, and a private company is now supplying consumers.

OTHER USES.

The destructor is also employed in lending a helping hand to a

neighboring authority by applying to the local board of Shirley and Freemantle, about two and one-half miles from the works, sufficient compressed air to work ejectors which they have erected in connection with the disposal of their precipitated sewage sludge from a population of 15,000. The compressed air is conveyed through a 4-inch main from the destructor works to their precipitation reservoirs, thus saving them the cost of a pumping station and bringing to the corporation a return of $1,000 a year, which is received for the compressed air. Thus the destructor works are now dealing with the sludge of nearly 30,000 inhabitants.

COST.

The initial cost of the complete destructor, including engine-house, inclined roadway, chimney shaft, boiler and ironwork, was $18,116.11, and the sewage disposal works on the town quay cost about $14,598. This is exclusive of the Shirley and Freemantle works, which consist of three reservoirs very similar in construction to those at the town quay.

The annual expense for burning refuse is as follows:

Two stokers, one by day and one by night	$632 58
Two feeders, one by day and one by night	590 39
Total per annum	$1,222 97

VALUE OF REFUSE AS FUEL.

The quantity of refuse burnt per day of twenty-four hours is a little over fifty tons, so that the cost of burning is about 3½ *d.* per ton. The minimum quantity burnt per day of twenty-four hours is about twenty-five tons, which has been sufficient to maintain steam for the engines of 31½ indicated horse-power. This is equivalent to 16 cwt. of refuse per indicated horse-power for twenty-four hours, or seventy-five pounds of refuse per indicated horse-power per hour.

The annual expenditure for the sewage clarification and disposal is as follows:

Precipitating material for 365 days	$437 94
Engine-driver and laborers at reservoirs	622 84
Two men at wharf mixing manure	506 06
Total per annum	$1,566 84

REVENUE.

The amount realized from the sale of manure and for the supply of compressed air during 1891 was $2,919.60. The products from the destructor, including concrete slabs, clinkers used for concrete foundations, and fine ashes for mortar and for foundations of footwalks, represent about $1,459.80. To these may also be added the saving of the coal which was required for working the engines previously to the establishment of the destructor.

William B. G. Bennett.

SPECIAL SPECIFICATIONS FOR ASPHALT, STONE BLOCKS AND BRICK.

THE form of contract for street paving in Columbus, Ohio, where a vast amount of work has been done within the last few years, especially in putting down brick, embraces special specifications for Trinidad asphalt, stone block and brick, as follows:

FOR TRINIDAD ASPHALT.

The following for wearing surface will be adhered to. The wearing surface will be composed of:

First. Refined Trinidad asphaltum.

Second. *Heavy petroleum oil.

Third. Fine sand, containing not more than five per centum of hydro-silicate of alumina.

Fourth. Fine powder of carbonate of lime.

The Trinidad asphaltum, so called, whether crude or refined, as found in the market, contains from 20 to 35 per centum of impurities, and must be refined and brought to a uniform standard of purity and gravity. The heavy petroleum oil, which may be the residum by distillation of the petroleum oils, as found in the market, generally contains water, light oils, coke and gummy substance soluble in water. This petroleum oil must be freed from all impurities and brought to a specific gravity of from 18 to 22 degrees Beaume, and a fire test of 250 degrees Fahrenheit.

By melting and mixing the two hydro-carbons (petroleum oil and asphaltum), the matrix of the pavement, called asphaltic cem-

ent, is manufactured, which cement shall have a fire test of 250 degrees Fahrenheit, and at a temperature of 60 degrees Fahrenheit, shall have specific gravity of 1.19.

It will be mixed in the following proportions by weight:

Pure asphalt	100 parts.
Heavy petroleum	20 "

The purity of the asphalt shall be ascertained and the quantity of heavy petroleum oil to be added to it shall be in accordance with the percentage of pure asphalt which it contains when crude.

The asphaltic cement being made in the manner above described, the pavement mixture will be formed of the following material in the proper proportions stated:

Asphaltic cement	from 12 to 15
Sand	from 77 to 72
Pulverized carbonate of lime	from 11 to 13

In order to make the pavement homogeneous, the proportion of asphaltic cement must be varied according to the quality and character of the sand. The engineer or parties duly authorized will make frequent inspections of the work where the pavement mixtures are manufactured, and will specify the exact amount of asphaltic cement between the limits above given, which shall be used in each batch. If the proportion of the mixture is varied in any manner from those specified by the inspector, the mixture will be rejected and condemned either before or after it is placed on the street. Its use will not be permitted and if already placed on the street it will be removed and replaced by proper material at the expense of the contractor.

The sand and asphaltic cement shall be heated separately to about 300 degrees Fahrenheit. The pulverized carbonate of lime, when cold, will be mixed with the hot sand in the required proportion, and then will be mixed with the asphaltic cement at the required temperature, and in the proper proportion, and in a suitable apparatus, which will effect a perfect mixture.

The pavement mixture in the manner thus indicated will be laid on the foundation in two coats. The first coat, called cushion coat, will contain from 2 to 4 per centum more asphaltic cement than above given; it will be laid to such depth as will give a thickness of one-half inch after being consolidated by a roller. The sec-

ond coat, called surface coat, prepared as above specified, will be laid on the cushion coat; it will be brought to the ground in carts at a temperature of about 250 degrees Fahrenheit, and if the temperature of the air is less than 50 degrees, the contractor must provide iron carts with heating apparatus, in order to maintain the proper temperature of the mixture. It will then be carefully spread by means of hot iron rakes in such a manner as to give a uniform and regular grade, and to such depth, that after having received its ultimate compression of two-fifths, it will have a thickness of —— inches.

The surface will then be compressed with hand rollers, after which a small amount of hydraulic cement will be swept over it, and it will then be thoroughly compressed by steam roller weighing not less than 250 pounds to the inch run, the roller being continued for not less than five hours for every one thousand yards of surface.

The degrees of fineness, both of sand and powdered limestone, will be determined by testing with screens to the satisfaction of the engineer. The powdered carbonate of lime will be of such degree of fineness that 16 per centum by weight of the entire mixture for the pavement shall be an impalpable powder of limestone, and the whole of it shall pass a No. 26 screen. The sand will be of such size that none of it will pass a No. 80 screen, and the whole of it shall pass a No. 20 screen.

FOR STONE BLOCK.

Stone pavement blocks are to be not less than three nor more than five inches thick, and not less than six nor more than seven inches deep, and from six to twelve inches long. The blocks must be so split and dressed as to form when laid close end joints, the side joints not exceeding one-half inch wide, with fair and true surface on top, bottom and ends, and all blocks whose side faces vary more than one-half inch from a rectangular shape will be rejected, but the ends of the blocks must be so dressed that they will make close fitting joints; blocks are to be set together in uniform rows; those of uniform thickness to be placed together in the same row, set upon two inches of sharp sand, free from loam or vegetable matter; blocks of less depth not to be "bolstered up," but must be set high and

settled to place by two or more blows of the iron paver; no gravel or sand to be placed on top as blocks are laid.

PAVING BRICK.

The brick or manufactured blocks must be hard burned paving brick or blocks specially burned for street paving, of uniform size, free from flaws, cracks or breaks, and equal in all respects to sample to be filed in the office of the city engineer by each bidder. No bats or broken brick or blocks are to be used except at the curbs, where nothing less than a half brick or block will be used to break joints. The brick or blocks to be kept in straight lines and all joints broken by a lap of at least two (2) inches, to be set upon two inches of clean, sharp sand, in a perfectly upright manner, as closely and compactly together as possible and at right angles with the lines of the curb, except at street intersections, where they are to be laid as the engineer may direct.

The paving to be thoroughly rammed two or more times—as may be directed, with a paver's rammer weighing not less than seventy-five pound—no iron of any kind being allowed on its lower face to come in contact with the paving; when complete to be the grade and crown of the street.

The joints or space between all paving blocks or brick to be filled full with coal tar paving cement, ordinarily numbered six. The composition shall be heated and used at a temperature of not less than 300° Fahrenheit, to be determined by a gauge or indicator placed upon the tank used in the street, or to be filled with Murphy's patent grout filling; extra material and care shall be used at the gutters in filling all joints in both paving and curbing, and around catch basins or other receptacles, to effectually prevent the leakage of water into the sub-roadway, all joints to be left completely filled to the top before dressing; the cement not to be used until the blocks or brick are completely dry. Bidders are required to state in their bids the amounts respectively, using tar filling or said grout filling.

The surface of the paving, when completed as above, shall be covered with a half-inch top dressing of clean, coarse sand of approved quality.

CURRENT INFORMATION.

DETROIT FAVORS BRICK AND CEDAR BLOCKS.

In the nineteenth annual report of the board of public works of Detroit, just issued, much space is devoted to the discussion of the street paving question. Detroit is one of the cities in which there has, during the last few years, been such general discussion of the subject that its citizens have, to an unusual degree, acquired a pretty thorough understanding in the merits of the different kinds of paving. Concrete foundations for all pavements have been determined upon. There is still difference of opinion, however, as to which is the most approved wearing surface, and on this subject the board says:

"In Detroit we have cedar on concrete, brick on concrete, Medina stone blocks on concrete, granite blocks on concrete, cobble grout on concrete, and asphalt on concrete; and expect soon to have a street of straight cobble on concrete. The least satisfactory of all these wearing surfaces on concrete in Detroit thus far has been asphalt. For business streets the board has no hesitation for declaring for first quality of paving brick, especially where the traffic is not too heavy, and for the heaviest traffic granite or Medina stone. For residence streets the least noisy pavement is cedar on concrete, while the board is satisfied of its cheapness and durability; and, properly laid, of its cleanliness, ease of and moderate cost of repair, comfort for travel, and other qualities highly commendatory. So well satisfied was the board of the good quality of this latter pavement that it has been making strenuous endeavors to have it made the only kind of cedar block pavement to be used. The cedar on plank and sand, with straight gutters, tile drain, improved filler, etc., was a great advance over cedar on sand, rolling cobble gutters, etc.; but cedar on concrete, with the other improved accessories, is as far in advance of a plank and sand foundation as was the latter in advance of plain sand. We had in Detroit, at the beginning of the paving season of 1893, about 500 miles of streets, of which 192.055 were paved as follows, the lengths being given in miles and thousandths: With granite, 9.967; wood, 82.669; wood and stone combination, 69.495; stone (including cobble, Medina and limestone), 14.588; macadam (including boulevard), 5.088; grout, 0.100; silica barytic, 0.082; asphalt, 14.215; brick, 4.851. There are in the city 29 square miles of territory, and its greatest length is 7⅓ miles, with a greatest width of 5 miles. With the new streets being dedicated or platted, and the 300 miles of unpaved streets already existing, it will be seen that there is ample scope for new paving operations for some time to come, to say nothing of the annual grist of repaving; and that it behooves us to lay the best kind of foundation from the start."

The present board of public works, composed of John McVicar, James Dean and Jacob Gulliard, has introduced many reforms in

the public work of Detroit, and, as shown by its report, has made a splendid record.

HYDRAULIC DRAW-BRIDGE AND AUTOMATIC DRAW-BRIDGE GATE.

The hydraulic draw-bridge and the automatic draw-bridge gate, recent inventions, will attract much attention, not only for their simplicity, and also ingenuity of construction, durability and economy in power, time and money, but for the safety of lives for which both inventions provide most effectually. The hydraulic draw-bridge was invented by Howard C. Holmes, of San Francisco, and is now in operation at ferry slip 3, at the foot of Market street in that city.

A lever, which, when put up, lets the draw down, and when put down, lets the draw up, regulates the whole thing. When raised, the lever sends the water into two horizontal rams, or cylinders, pushing back the piston, which carries two little trucks along a track to which are attached heavy one and three-eighth inch chains, that pass over pocket wheels and down to the bridge on the outer or bay side. Two other chains of the same size are attached to heavy masses of iron which pass over two other pocket wheels to the bridge, counterweighing the bridge itself, and making four safeguards, for one of the chains alone is strong enough to hold the bridge. When loaded with passengers, the weight of the bridge is about 30,000 pounds, and the breaking strain of each chain is 200,000 pounds. A safety clutch, consisting of a ratchet wheel and a pawl on the top frame of the bridge, is provided against mishap of any kind. Through the action of the lever, the pawl moves automatically in the cogs of the wheel, rising with the lever and falling with the bridge, so that the latter can go no lower than desired by the man at the lever. The bridge is raised by water and lowered by forcing the water out. Nothing has been overlooked by engineer Holmes, it is said, in the construction of the draw-bridge. Engineer Holmes personally superintended the running of the draw-bridge, which, for a month was subjected to the most severe tests for the purpose of ascertaining the exact manner in which it would work when placed in actual use. The steamer Encinal, which was the first steamer to glide into the slip, went in without a bump, and a second later the draw was lowered and the apron dropped on the deck of the Encinal. The draw-bridge has never been equalled in any port.

George F. Ryan, of Chicago, invented the automatic draw-bridge gates, which are hung on upright iron posts about twenty feet from the draw, the posts extending beneath the bridge to the open space below, and are so placed that they easily revolve. On the lower end of each post is a crank which connects with a cross shaft connecting the two posts. The shaft is crooked in the middle to form an eye from which the main shaft runs to the draw. On the end of this shaft is a large cogwheel and a steel "comb" which is fastened underneath the turn bridge, fits into these cogs. When the bridge opens, the first motion rings a gong, and the comb, running over the cogs, turns the shaft, and the gates close. They open again when the bridge closes, the gong ringing again as the gates open. The bridge can not open without closing the gates, and can not close without opening them. Both inventions are easily operated, it requiring but one man to work either.

EMPLOYMENT OF IDLE MEN IN PUBLIC WORKS.

The action of authorities in several cities, who, in the beginning of the financial and industrial depression, found employment for idle labor has attracted attention from other cities and towns, and city councils and county commissioners are falling into line and urging the need of public works that will alleviate distress and give work to the unemployed, and at the same time prove beneficial as an improvement.

A permanent committee of relief was appointed in Chicago, recently, consisting of fifteen members, representing labor, commercial and municipal interests. A division of labor, by shortening the hours of work in stores and shops, has been suggested, in order to share with all alike the employment provided. The drainage board will give work to about 1,500 laborers, on the drainage canal. It is proposed that the men to be employed shall be citizens and heads of families, so that in this way relief will be afforded to from 5,000 to 6,000 persons. The park commissioners will give work to as many as possible, and unusual vigor will be prosecuted in street improvements, by which means it is hoped to give employment to 15,000 or 20,000 men during the winter.

Similar means of helping the idle poor will be provided in Cleveland, where the park and boulevard commissioners are making ready to put men to work during this crisis.

An effort is being made at Minneapolis to commence work on the roads and bridges, and various plans are discussed as to the best possible means of giving work to the idle laborers.

Mayor Barnes, of Kansas City, Kas., proposes the construction of a boulevard in that city, in order to give employment to idle men. The boulevard, which would be about seven miles long, will cost $300,000, and, by paying for it in city bonds of small denominations, and drawing six per cent. interest, he thinks that money will again be put into circulation, whose it is now hoarded up. A clause, prohibiting the employment of any except bona fide residents of Kansas City, Kan., will be inserted in the contracts.

More than a thousand applicants presented themselves for a chance to work at the new reservoir at Waterbury, Conn., and while only about 100 could get work at the time, an endeavor will be made to accommodate a great many more.

Col. Albert A. Pope, of Boston, in an open letter, suggests that legislatures and city and town authorities take immediate steps to furnish employment in the construction of public works.

These are only a few instances of the practical methods being devised all over the country to avert distress and actual want during continuance of financial depression.

DISCUSSION INTERESTING TO STREET ENGINEERS.

At the meeting of the association in Nashville, Tenn., September 14, Mr. W. G. Williamson discussed the relations of the city council, the board of public works and the city engineer. He concluded that in small cities the existence of both the council and the board causes needless complications, though in large cities the great amount of public work makes the board more efficient than a committee of the council; that the engineer should be appointed by the board, but should not be embarrassed by their appointing any of his assistants; that orders to the engineer should

come from only one authority, and if these orders are contrary to the engineer's judgment, he should be allowed to put his objections on record; and that it is not a good policy to bind an engineer to let work to the lowest bidder.

The paper of Mr. Walter G. Kirkpatrick described a "System of Triangulation for River Surveying." The field work consists of reading four angles at each of a series of stations on one river bank, the distance between the first two stations and that between the last two being measured with a tape. The computation is simple, a connected series of sine proportions, so that the addition of logarithms is cumulative, each addition evolving the length of a line in the system. The platting is by chords, such a check being afforded as to detect any error. The system, though accurate, requires but little more work than the ordinary transit and stadia survey; the computation can be framed from the field notes, then all the logarithms taken from a table, then all the additions made, evolving all the necessary distance, with which the platting proceeds in a connected chain.

Mr. J. S. Walker discussed the roof trusses of the World's Fair buildings.

Mr. Hunter McDonald outlined the methods and progress in sinking caissons forty feet under water for the foundations of the bridge now under construction across the Tennessee river at Johnsonville for the Nashville, Chattanooga and St. Louis Railway.

The Association will meet next on October 12.

Walter G. Kirkpatrick, Sec'y.
35 Woodland Park, Chicago, Ill.

STATE ROAD CONVENTION.

The state road convention, which recently met at Sacramento, Cal., accomplished great good, inasmuch as those in attendance claimed that they would go away full of food for thought and made wiser by the conference, which set in motion good road agitation.

The committee on resolutions presented the following report:

1. Favoring engineering supervision of roads in each county, a state road bureau or commission, to advise and direct road construction, that chief roads should be built by the state.

2. That each county should have engineering supervision of roads.

3. That the question of bonds for road construction be deemed local and not a subject for the conventions.

4. That a broad-tire system be advised according to weight carried.

5. That the contract system for maintenance of county roads is wise and should be encouraged.

6. That the ten-block system of numbering roads be approved.

7. That the League of Wheelmen should be thanked for its warfare against bad roads.

8. That chief roads should be general charges upon the whole county, and road districts should be abolished.

9. That sprinkling of roads is essential to their preservation.

10. That the convention consider in what portion of the state, if any, the new road law is satisfactory.

11. That management of public roads should be taken out of local politics.

12. That an executive committee be chosen to prepare a road bill for the next legislature, in accordance with the suggestions of the convention. Such bill to be submitted to the next convention. Said committee to organize a plan of action, collect statistics and devise methods

for construction, improvement and maintenance of public roads in the state.

The executive committee was announced as follows: A. B. Lemmon, Sonoma, chairman; H. Weinstock, Sacramento, secretary; J. M. Fulton, Lassen, treasurer; J. R. Price, Colusa; J. L. Maude, San Bernardino; J. A. Fletcher, Placer; Thomas R. Knox, San Francisco; J. L. Gilbert, Fresno; Thos. McConnell, Sacramento; J. A. Linscott, Santa Cruz.

AMERICAN WATER WORKS ASSOCIATION.

The thirteenth annual convention of the American Water Works Association was held in Milwaukee, Wis., September 5–9. During the week the following interesting papers were read: "Geology of Wisconsin Water Supplies," by David W. Mead, Rockford, Ill.; "Some Experience Regarding Deep Wells," F. A. W. Davis, Indianapolis, Ind.; "Municipal Acquirements of Private Water Company Plants, as Illustrated by the Syracuse, N. Y., Water Company Condemnation by the City," S. E. Babcock, Little Falls, N. Y.; "A Water-works Man on a Round for Items, or a Chiel Amang Ye Taking Notes," by W. L. Cameron, Kansas City; "Incidents in Water Supply Tests," J. T. Fanning, Minneapolis, Minn.; "The Office of Civil Engineer in Small Cities," H. F. Dunham, New York City; "The New Orleans Case," L. H. Gardner, New Orleans; "Is our Drinking Water Dangerous to Health;" John W. Hill, Cincinnati, Ohio; "Electrolysis and Its Effect on Water Pipes," Peter Milne, New York. The nominating committee presented the names of the following members for officers, who were elected: President, James P. Donahue, Davenport, Iowa; First Vice-President, William Ryle, Paterson, N. J.; Second Vice-President, H. G. Holden, Nashua, N. H.; Third Vice-President, C. E. Bolling, Richmond, Va.; Fourth Vice-President, John Campbell, St. Paul, Minn.: Fifth Vice-President, F. A. W. Davis, Indianapolis, Ind.; Secretary and Treasurer, Peter Milne, New York. Several cities, including Minneapolis, Indianapolis and Richmond, Va., wanted next year's convention of the association, and, after taking two ballots, Minneapolis was selected.

RAPID TRANSIT FOR NAPLES.

A project is in progress to provide inter-communication between the low level and high level sections of Naples, by a system of rapid transit, which at present is poorly supplied with means of transit. Two metallic viaducts, each divided so as to form a double way, one for the operation of electric cars, and one for persons on foot, is the plan on which the line is to be carried. A masonry tower, 325 feet high will be built in the Via Roma, and the first viaduct, which is 1,180 feet long, will be carried from this to the Corso Vittorio Emanuele, where it will terminate at the base of a metallic tower 490 feet in height.

The second viaduct will be 950 feet long and will branch out from this tower, some distance below the summit, passing over the San Martino hill and ending in the ground level at the Rione del Vomero.

Staircases and elevators will be provided in the metallic tower connecting the two viaducts for passengers going up and down, and the two viaducts will be carried on

pyramidal metallic towers, erected on masonry foundations.

Passengers entering the car at either end of the line will not be required to change their seats on arrival at the towers, for the cars will be automatically raised or lowered, and will continue their way to either end of the road.

FRICTION CLUTCH.

The latest of the invariably handsome catalogues of J. W. Penfield & Son, Willoughby, O., is devoted to the Imperial Friction Clutch, manufactured by them. They claim for their friction clutch that it embodies the advantages of other styles, without their defects, as it has few parts, and is free from complicated devices. The clutch is compact, takes two inches space on the shaft, and runs easily. It may be easily adjusted or repaired. The bushings are easily removable. The friction surfaces are extra large, making the clutch very powerful, and are protected by renewable strips of insulated fiber. Speed is unlimited and it is claimed centrifugal force can not affect or harm Imperials.

The complete description of the operation of the clutch is given in the booklet just issued, which will be sent to any address, by J. W. Penfield & Son, upon application.

A VALUABLE DEPOSIT OF PAVING MATERIAL.

A deposit of valuable material, called Macadam, which is practically inexhaustible, is found near Bartow, Florida. The first stratum is yellow, clayish sand, mixed with sandstones, which vary in size from a marble to eight or ten inches in diameter. In some places this is overlaid with a few feet of soil, while in others it crops out on the surface, and, in appearance, this resembles pure, yellow sand, but, upon exposure, it soon hardens and becomes as valuable as any other part of the deposit. The next stratum is a grayish clay of uniform texture, mixed with tiny, white phosphate pebbles. No attempt has ever been made to go below the water line, so the depth of this stratum remains unknown. The results obtained from this material, for paving, have been of the most favorable.

DEMAND FOR PUBLIC PARKS.

A simultaneous demand for public parks seems to have come into prominence all over the country, and it is one that can not be too urgently encouraged, for parks are essentially requisite to the attainments of a modern city. Thrifty cities, with a rapidly growing population, can not acquire more land for park purposes than will be needed, and it should be secured now, before it becomes exorbitantly expensive, and before the demand for such land for other purposes places it beyond reach. Apace with the growth of a city, is a desire on the part of the people for grounds laid out with plats of grass and shade trees which seem to give them breathing space.

NOTES OF PUBLICATIONS.

Electricity, of September 6, issued a supplement representing the members of the International Electrical Congress, held in Chicago, August 21–25, which makes a very handsome appearance.

The C., H. & D. Railroad have issued a handsome panoramic view, five feet long, of Chicago and the World's Fair, showing relative heights of the prominent buildings, etc. Also a handsome photographic album of the World's Fair buildings, either of which will be sent

to any address postpaid on receipt of 10 cents in stamps. Address D. G. Edwards, General Passenger Agent World's Fair Route, 200 W. 4th street, Cincinnati, O.

STREET RAILWAY ASSOCIATION.

The twelfth annual convention of the American Street Railway Association, will be held in Milwaukee, Wis., October 18, 19 and 20.

PERSONALS.

Prof. Chas. C. Brown, of Schenectady, N. Y., was appointed consulting engineer of the system of sewers planned for the city of Frankfort, Ind.

Mr. Ernest V. Clemens, mechanical superintendent of the De La Verne Refrigerating Machine Co., New York, died on Saturday, September 3, 1893, after an illness of several weeks.

Mr. Alexander Potter, Assoc. M. Am. Soc. C. E., of New York city, has been appointed to furnish designs for an entirely new system of water supply for Winchester, Va.

Mr. James C. Meen, of Buena Vista, Va., has been elected engineer of the sewer department, Wilmington, Del.

Mr. L. A. Dunham, of Plainfield, N. J., has been elected superintending engineer of street paving in Poughkeepsie, N. Y. Mr. Dunham has charge of similar work in Dunkirk, Hornellsville and other cities in Western New York.

Mr. Thos. G. Clayton, of Derby, superintendent of construction of the Midland railway of England, is the guest of his brother, James Clayton, president of the Clayton Air Compresser Works, New York. While in this country, Mr. Clayton will visit the World's Fair, and study our railway systems.

Mr. Walter Lodia, Paris, France, a well known contributor to this and other technical publications in this country, is visiting the World's Fair. Mr. Lodia has the distinction of having traveled over France and Spain afoot, for the purpose of inspecting the roadways of those countries.

SELECTIONS FROM THE PRESS.

HEAVY LOADS ON ASPHALT.

Recently a cable weighing thousands of pounds was transported through some of the principal streets of New York city. It was carried on a truck built especially for the work it had to perform, with wheels whose tires were three or four times as wide as on the ordinary truck, in order to prevent them from sinking into the pavements and thus greatly damaging the streets, to say nothing of increasing the difficulty of hauling the enormous load. To the great surprise of the contractors the load was carried with the greatest ease and the least damage over the asphalt-paved streets. In several places the granite block pavements were crushed and depressed, and in one instance the wheels sank so deep as to necessitate their prying out with jacks, while on the asphalt pavement, which was supposed to be wholly unsuited to heavy loads, no trace of the passage of the enormous mass was to be discovered.—*Manchester Union, N. H.*

STREETS AND HIGHWAYS IN GREAT BRITAIN.

The favorite roadway construction in the United Kingdom is that introduced by Macadam. Not only are the majority of country roads thus built, but in the towns and cities, the streets, with the exception of those subjected to heavy travel, are macadamized. The best roads are to be found in Scotland, where they have excellent granites in great abundance; their Guernsey granite is said to be the most durable in existence. In Glasgow are streets paved with blocks of square dressed granite where the pavement remained undisturbed for thirty years under the heaviest traffic, and the same blocks when lifted and redressed are expected to live twenty-five years longer. No blocks are now allowed there exceeding four and a half inches in width or nine inches in length, so as to secure a good foot-hold for the horses. But in Glasgow, Edinburg, and other Scotch cities, the streets used for lighter traffic are, as elsewhere in Britain, constructed according to the principles laid down by John Loudon Macadam.

Macadam was a Scotchman, though he spent a part of his youth in the United States. He began road-building in 1816, discarding the old plan of a highly curved surface, making his roads nearly level. He insisted that a good road should be as flat as possible, with only just enough slope to allow the water to escape. His roads were but three inches higher in the middle than at the sides, and all parts made equally hard. He maintained that if a roadway were not flat, carriages, which needed to be kept upright, would go for the middle, where would be the heaviest traffic, but if made flat, all parts of the roadway would receive equal wear. The roadway itself was built on the principle of small angular blocks so put down that they should form by the union of their angles a solid, hard surface. Such a road would remain in the position placed, whereas the pebble or gravel formerly used must remain in constant motion. Mr. Macadam's favorite method was first to loosen the hard surface with a pick, then cover it with a layer of broken stone, about four inches thick. This layer was worked or rolled until "set," then a second layer put on likewise, and afterward a third. The broken stone used was whinstone, or flint, or limestone when the harder varieties could not readily be obtained. These were broken until they would pass through a two-inch or two and a half-inch ring. The present methods vary but little from those introduced by Mr. Macadam, except that the machine crusher takes the place of hand-work, and the steam-roller that of the old-fashioned "pounder" or light roller drawn by horses. In Scotland a favorite method in constructing a new road is first to place a layer of 3-inch to 6-inch tiling on each side of the road for thorough drainage, placing it usually some three feet below the surface. The cost of laying the tile is said to be not over three or four cents per yard. The layers of broken stone are then laid as previously described. The total cost of constructing an 8-foot road is about $1,500 per mile.

In laying city pavement a 6-inch cement concrete foundation is customary, although the thickness of this may vary somewhat with varying conditions. In laying the macadam a 4-inch foundation of sand or sand and gravel is used in some localities. The telford pavement, which is used to some extent, dif-

fers from the macadam only in that the former has a bottoming of large wedge-shaped stones, laid sharp end uppermost, with a covering of broken stone, or "metal," as it is termed, while the macadam uses only broken stone or "metal" throughout. Telford was also a Scotchman, but the pavement he introduced is far less popular than that of J. L. Macadam.—*American Contractor.*

BRIDGES IN ENGLAND.

The scientific construction of great bridges in Great Britain has been studied with much diligence from earliest times, and has quite equaled the progress in the other branches of architecture. The most ancient bridge in England is the Gothic triangular bridge at Coryland, in Lincolnshire, which is said to have been built in 860. This singular structure has three approaches from as many roads, formed by three segments of a circle which meet in the middle and from three pointed arches.

The longest bridge in England is that over the Trent at Burton, in Staffordshire, built in the twelfth century of squared freestone. It consists of thirty-four arches and is 1,545 feet in length.

The old bridge at Newcastle-Upon-Tyne was built of stone in 1281, and that over the Medway, at Rochester, about the same time.

The London bridge was composed originally of twenty-two arches, and was incumbered for many years with a street of houses, which was removed between 1756 and 1758, and the three center arches were then converted into one of 72 feet span.

The bridge built over the Conway at Lianrwst, in Denbigshire, by Inigo Jones, in 1630, may be classed among the best of the English bridges, although it lies in Wales. It consists of three arches, the largest of which is fifty-eight feet span. The road and the parapet are very low and the approaches steep, and the bridge has an unusually light and airy appearance.

Another beautiful and singular bridge in Wales is also worthy of notice—that built in 1746 over the Taff, in Glamorganshire, by William Edwards, an uneducated country mason. Some time after its erection it was, unfortunately, carried away by masses which the torrent of the river drove against it. As the builder had given security for the durability of his work for seven years he was compelled to erect another, which he did with all possible speed. The second bridge consisted of one arch, for the purpose of admitting freely through it whatever incumbrances the flood might bring down. The arch was completed, but before the bridge had received the parapets the weight pressed in the haunches, raised up the crown, and laid the fine arch in ruins in 1751. At the third attempt the bridge was completed and has since gallantly withstood the test of time and flood.—*London Tid Bits.*

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Macadam paving, recently finished at Iowa City, Ia., cost $14,000.

West Jefferson street, between Mason and West streets, Bloomington, Ill., is being paved.

Delphos, O., has purchased a new street roller from the Enterprise Manufacturing Company, of Columbiana, O.

At a recent meeting of business men of Johnstown, Pa., it was decided to borrow $800,000 for street improvements.

Property owners on Jefferson street, Toledo, O., are petitioning for the paving of that thoroughfare with cedar block.

The macadamizing of Eighth street, Oakland, Cal., now under course of contruction, will, when finished, make one of the finest streets in that city.

A conservative estimate of the number of miles of streets to be repaved in Kansas City, Mo., during the next year, shows thirty miles of needed work.

The board of works, Detroit, Mich., has under course of construction $310,690.29 worth of paving, which, with the contracts awarded, but not yet begun, will make the amount half a million dollars.

Several miles of fine paving have been laid in Toledo, Ohio, this season. The aggregate cost of the work is about $500,000. Lincoln avenue, from Monroe street to Waite avenue, is now under construction, and East Broadway will be paved before winter.

The prices of paving which is being done in Belle Vernon, Pa., are as follows: Grading, 27 cents per cubic yard; paving, brick on 8 inches gravel and 2 inches sand, $1.25 per cubic yard; curbing, 65 cents per lineal foot. Mr. Albert Smith is superintending the construction of the paving.

Yamhill street, in Portland, Ore., is being paved with seasoned fir blocks, six inches square in the surface, and five inches in length, set on a concrete foundation. Spaces, half an inch in width, are left on all sides, which are filled with gravel and then a boiling mixture of coaltar and asphalt is poured over all, and the whole covered with sand. It is conceded that the pavement has no superior for smoothness and noiselessness.

During the present year a great number of streets have been paved and opened for traffic in Rochester, N. Y. Medina block, of the most expensive and durable kind, has been the favored pavement, although some asphalt and brick pavements have been constructed, and macadam pavements have been repaired.

Oskaloosa, Ia., has several blocks of fine brick paving. Sixteen blocks, from G street to Ninth street, eight blocks on First avenue, two blocks on the east and west of the park, which, with the three blocks on Market street and eight blocks on Rock Island, nearing completion, will make thirty-seven blocks.

Gay street, between Main and Hill streets, Knoxville, Tenn., has a foundation six inches in depth, and composed of sand, cement and crushed rock, mixed with water, and then spread evenly over the surface of the street and tamped. It is allowed to stand in this condition for sixty hours before the brick are laid.

Eugene Kirk, Youngstown, O., writes that the paving of Elm street, between Madison avenue and Grant street, is finished, and the grading of Glenwood avenue is nearing completion, under the supervision of John Kane. West Federal street, which is being macadamized by George Vetter, will be one of the finest streets in the city.

East Adams street, in Springfield, Ill., which was completed about two weeks ago, is three-quarters of a mile in length, and consumed 1,375,000 bricks, 1,700 loads of cinders and 1,355 loads of sand, and will cost more than $20,000. The pavement gives much satisfaction, being one of the most substantial and beautiful streets in the city since its completion.

Hudson street, between Eighth and Tenth streets, Hoboken, N. J., has been repaved. The roadbed consists of a twelve-inch foundation of crushed stone, with a top dressing of heavy layers of stones, of graduated fineness and Telford finish, and rolled to solid compactness by powerful fifteen-ton rollers. By the free use of water during the rolling process, an even and solid street, with just the proper proportion of yield to make a perfect driveway, has been constructed. William Ellis had the contract for the paving, and it is probable that other streets in Hoboken will be paved in a similar manner.

The board of public works, Denver, Colo., passed a resolution and ordered the city council to pass an ordinance ordering the establishment of the Nineteenth Street Paving District No. 1, from Larimer to Broadway, at a total cost not to exceed $51,010.18 to the property owners. The board of aldermen has also appropriated $6,500 for work on the streets.

Tilden street, Saginaw, Mich., was paved this year, under the Telford specifications. The stone used was Bay Port stone, which is quarried about fifty miles from Saginaw, put on 14 inches thick, and curbed with Ohio sandstone. The heaviest team traffic in the city traverses this street, but the tires of a wagon do not affect the surface of this paving any more than it would an asphalt pavement.

Assessments for the following streets in Indianapolis have been made: Pearl street, brick, $2,612.30; Massachusetts avenue, asphalt, $13,904.16; Delaware street, asphalt, $21,710.64; Shelby street, asphalt, $37,969.63; sidewalk in Keystone avenue, $3,502.40; sidewalk in Market street, $977.90; Alabama street, $23,355.42. The three streets recently accepted by the city, South Pennsylvania street, Prospect street and Massachusetts avenue, make a nice appearance with their smooth asphalt surface.

CONTEMPLATED WORK.

Plainfield avenue, Detroit, Mich., will be paved with brick.

Richmond, Ind., will pave Main street, as far as Twentieth street.

Broadway street, Kenton, O., will be paved with Hallwood block.

Sixteen or twenty blocks of streets will be paved with brick at New Orleans.

An alley in Iowa City, Ia., will be paved with stone, at 62½ cents per square yard.

Watertown, N. Y., will spend $18,000 on street improvements during the coming year.

About $3,000 will be expended in improving Crystal Lake road, in the village of Crystal Lake, Minn.

An ordinance to pave East Broadway, from Starr avenue to Woodville street, has been approved in Toledo, O.

A portion of Cannon street, Poughkeepsie, N. Y., will be paved with vitrified brick on concrete foundation.

Griswold, Conn., has voted to expend $15,000 in constructing a macadamized road between Jewett City and Pachaug.

John G. Zane, Escanaba, Mich., writes that the city contemplates expending $5,000 in improving roads leading from the city.

The board of public works, Kansas City, Mo., approved the ordinance for the paving, with vitrified brick, of Locust, Oak and Twentieth streets. Grand avenue will be paved in two sections, from Ninth to Thirteenth and from Thirteenth to Twentieth, with asphalt.

The street committee acted favorably upon the resolution, which recommended the macadamizing of the north lateral roadway of Humboldt parkway, Buffalo, N. Y., at a cost of $2,500, and the northwesterly drive of Bidwell parkway, for $9,000. The committee also contemplates paving Thomas street, between Metcalf and Williams streets, and Alabama street, from Elk to Sandusky streets.

Fitzhugh street, between Main street and the canal bridge, Rochester, N. Y., will be paved in accordance with an idea of City Surveyor McClintock. On the present macadam pavement will be laid a layer of hard trap rock, the size of the rocks being such that they would pass through a two-inch ring. This will be rolled with a heavy steam roller and then covered with a thin layer of Portland cement mortar. Mr. McClintock claims that for smoothness, cleanliness and durability, it will be equal to any pavement, and will not exceed $1 per square yard in cost.

CONTRACTS TO BE LET.

Bids will be received until October 2 for paving Junction avenue, Toledo, O., with either cedar blocks or vitrified brick.

Sealed proposals will be received until October 4, Cincinnati, O., for the improvement of Fairview avenue and Straight street.

Bids will be received until October 16 for improving 300 feet of Liberty street, Cincinnati, O., by paving with granite blocks.

Bids will be received at Cincinnati, O., until October 16, for improving Heywood street, from Colerain avenue to Fourth avenue, by paving with brick.

Sealed proposals will be received at Frankfort, Ind., until October 4 for 2,000 feet of 3 inch by 24 inch limestone curbing, and the construction of a gutter with a 36 inch apron.

Bids are invited until October 6, Altoona, Pa., for paving the alley between Green and Chestnut avenues, and between Tenth and Eleventh streets, with vitrified fire brick, Telford macadam, Barber block, or Belgian block.

CONTRACTS AWARDED.

The Warren-Scharf Asphalt Paving Company was awarded the contract for constructing an asphalt pavement on Linwood avenue, between Main street and Livingston avenue, Columbus, O.

The contract for paving Water street, Trenton, Mo., was awarded H. B. Payne & Co.

The contract for macadamizing at the South End, Hartford, Conn., was awarded J. S. Lane & Son.

Messrs. Ryan and Burke secured the contract for paving Fourth and Belle streets, Alton, Ill.

Mr. J. G. Galbraith was awarded the contract for paving East Marion street, Lancaster, Pa., with vitrified brick, at $2.15 per square yard.

The contract for repaving, with asphalt, St. James place, from Gates avenue to Fulton street, Brooklyn, N. Y., was awarded Crawford & Co.

The Trinidad Asphalt Refining Company, of New York, has been awarded the contract for paving Fort street, from Griswold to Woodard streets, Detroit, Mich., for $6,980.81.

The contract for paving, with asphalt, Jefferson street, from Wisconsin to Mason streets, Milwaukee, Wis., was awarded the Warren-Scharf Asphalt Company, at $2.39 per square yard.

The contract for grading Crescent street, Youngstown, O., between Moore street and Manning avenue, has been awarded W. B. Riblett, and the contract for grading Pyatt and Lett streets has been awarded John Kane.

D. and J. Murphy were awarded the contract for paving, with 6-inch cedar blocks, from Nicholson street to Prairie avenue, and lay 6-inch water mains, in Joliet, Ill. The work is to be completed by December 15, and will cost $14,372.

Contracts were awarded, Buffalo, N. Y., to the German Rock Company, for paving Grider street, from East Ferry to LeRoy avenue, for $91,231, and to the Barber Asphalt Company, for paving Washington street, from Mohawk to La Fayette streets, for $1,084, and for repaving 125 feet of Niagara street, $1,891.

O. H. Tripp, civil engineer, Rockland, Me., writes that the contract for 2,500 square yards of paving, and setting the curbing for brick walks, was awarded Elijah Norton, of Cushing, at 20 cents per square yard for paving, 8 cents per square yard for setting the curbing, and 16 cents per square yard for laying the brick.

J. M. James, Sioux Falls, S. D., writes that the contract for paving and curbing Ninth street, from Phillips avenue to Dakota avenue, has been awarded: For paving with granite blocks, Robert Telford, $1.77½ per square yard, amounting to $4,061.20, and for curbing with granite, Wm. Adan, 96 cents per lineal foot, amounting to $583.68.

A. O. Jones, Zanesville, O., was awarded a contract for street paving in Mansfield, O., which will require one million brick.

The contract for paving Fourth, Fifth and Eighth streets, from Ohio to Cherry, Terre Haute, Ind., was awarded J. E. Voorhees & Co. The paving, Veedersburg brick on five inches of concrete, will cost $2.05 per square yard, between the curbs, making the cost to property owners $4.66 per lineal foot. The paving of Second, Third, North Sixth and Ninth streets was postponed until it is decided whether asphalt or brick will be used.

W. M. Shinnick, Jr., City Clerk, Zanesville, O., writes that the Council has awarded to Adams Bros. the contracts for paving 10,100 yards of River street with Harris paver and sand filling, at $1.04 per yard; 4,300 yards of North Fourth street, with Harris paver and sand filling, at 99 cents per yard. The contract for paving 4,300 yards of North Fifth street with Harris paver and sand filling, was awarded E. J. Tracy, at 93 cents per yard.

Udo Hesse writes that contracts have been awarded in Saginaw, Mich., as follows: Macadamizing Fitzhugh street, from Warren to Wradock, Peter Malcolm, $792; macadamizing Holden street, from Washington to Jefferson street, A. L. Sager, $3,100; paving, with sapless cedar, Genesee avenue, from Mary street to Saginaw river, Scanlan & Crowley, $595; macadamizing Mackinaw street, A. L. Sager, $1,640; paving Michigan avenue, from Court street to Bristol street, with sapless cedar blocks, Peter Malcolm, $23,560.

Henry W. Scott, Seattle, Wash., writes that the following contracts have been awarded in that city: Willow street, J. H. Bailey, $2,290; Thomas street, McDonald & Hall, $4,215.39; Dyer avenue, Taylor Bros., $2,558; Pike street, Taylor, Bailey & Co., $13,743.76; Harrison street, Charles E. Teek, $8,649.45. Pike street is the most important, inasmuch as it is only four blocks long (about 1,200 feet), and will need 60,000 cubic yards of earth and 150,000 feet of lumber; the maximum cut will be 52 feet, and the maximum fill will be 36 feet.

Chas. L. Proda, City Engineer, Santa Cruz, Cal., writes that 5,000 square feet of macadam paving has been let in that city by private parties, at 5½ cents per square foot. The work will consist of excavating to a sub grade of about 10 inches on an average in depth, and to lay broken limestone to a depth of 12 inches in the center of the roadbed, and 8 inches in the gutters. The rock will be put down in two layers and each layer rolled, and the top is to be covered with a coat of rolled gravel. The work is to be done under the supervision of the street superintendent.

The following paving contracts have been awarded at Detroit, Mich.: Middle street, from Grand river to Clifford street, Talbot Paving Co., $3,039.37; Perry street, from Grand river to Trumbull street, H. A. Brossard, $7,432.72; Junction street, from Fort to Dix street, T. J. Kennedy, $20,434.05; Junction street, from Dix to Michigan Central tracks, Patrick Dee, $16,681.38; Buchanan street, from Maybury to Scotten street, H. A. Brossard, $16,003.80.

SEWERAGE.

Bonds to the amount of $50,000 are being sold in Racine, Wis., for sewer purposes.

A special election held at North Tonawanda, N. Y., favored raising $60,000 for sewers.

The sewer commissioners, Hartford, Connecticut, have seven sewers under course of construction.

The Chippewa street sewer, Flint, Mich., is completed. It is considered one of the best sewers in that city.

A plot of ground has been offered the Englewood Sewer Company, Jersey City, N. J., by William Walter Phelps for the erection of a sewerage plant.

The largest sewer assessment ever made in Des Moines, Iowa, was recently completed, and is known as sewer system No. 2, of 1893. An area of 600 acres in the northwestern part of the city, a little more than eleven miles long, is embraced, at a cost of $125,726.85, the cost to abutting property being $1.35 per foot front.

The commercial club at New Albany, Ind., has been in correspondence for several months with Mr. Alexander Potter, civil and sanitary engineer of New York City, in regard to sewers and street grades. A few weeks since Mr. Potter made a visit to New Albany and held a conference with the commercial club, and has, since his return, written the club a letter stating that he is in a position to propose to the city council to make drawings for a complete system of sewerage and street grades for the city for $3,000.

The city council of Belleville, Ill., unanimously adopted a system providing for the latest improvement for the removal of sewage, including the domestic flow from bath-tubs, wash-stands, water-closets, kitchen-sinks, etc. Mr. Edward Flad, civil and mechanical engineer, St. Louis, Mo., prepared the plans and specifications, which provides a capacity for a population of 40,000 people, and will require about 37 miles of main and lateral sewers, at a cost of $180,000. The system reflects great credit upon Mr. Flad's ability as an expert sewer engineer. The construction of the system will be commenced as early as possible.

The sewer committee of Holyoke, Mass., has ordered the city treasurer and finance committee to issue bonds for $100,000, to be used for new sewers. The bonds are to be for 20 years, at 4 per cent. interest per year.

CONTEMPLATED WORK.

Meriden, Conn., contemplates a system of sewers.

Seattle, Wash., contemplates having new sewers constructed.

Charlevoix, Mich., is considering the building of a sewer system.

Detroit, Mich., contemplates building an $8,000 sewer on East Main street.

Freeport, Ill., contemplates a storm sewer for upper Stephenson street.

Fifteen hundred feet of pipe sewer will be constructed in Port Huron, Mich.

Sewers will be constructed in Main, Superior and Section streets, Oconto, Wis.

About 1,800 feet of sewer will be constructed in Fourth street, Delphos, Ohio.

Appleton, Wis., contemplates the construction of a sewer which will cost about $10,000.

A twelve-inch vitrified storm sewer will be constructed in East Market street, Bloomington, Ill.

A new sewer is contemplated at Kansas City, Mo., in District 132, which will cost between $22,000 and $25,000.

Sewers will be constructed in Beechwood, Dana, Emmet, Lessing, Maud, Norwood, Platt, Stanton and Wooley streets, Cleveland, Ohio.

A mammoth sewer in Walworth run, Cleveland, Ohio, will be constructed. It will be two miles or more in length, and large enough in some places to admit a team of horses and wagon. The sewer will drain all of the West Side, south of Franklin avenue.

Alonzo J. Hammond, city engineer of Frankfort, Ind., writes that the plans for a new sewerage system have been completed, and twenty-two miles of sanitary sewers, from twenty-four inches to eight inches in diameter, will be constructed at a cost of $135,000. The city also contemplates some 300 feet of thirty-inch brick sewer.

O. R. Rauchfuss, Joliet, Ill., writes that D. and F. Murphy were awarded the contract for a six-inch vitrified sewer pipe, to be laid in the center of Western avenue, from Clement street to Prairie avenue, consisting of 1,890 feet 55 4-inch branches, 990 feet 4-inch house connections, 1,900 cubic yards excavation, 7 manholes and 1 automatic flush tank. The contract price is $1,200.

The board of commissioners of Flemington, N. J., contemplates the construction of sewers in fifteen streets, and have notified the property holders along streets fronting the proposed sewers.

B. R. Morton, city engineer, Newport Ky., writes that sewers will be constructed in the following streets: Elm street, between Isabella street and Licking river; Eighth street, between Isabella street and Licking river; Fourth street, between Washington avenue and Park avenue; Fifth street, between Washington avenue and Park avenue; Sixth street, between Saratoga street and Park avenue; Seventh street, between Washington avenue and Park avenue; Eighth street, between Washington avenue and Park avenue; Tenth street, between Washington avenue and Monroe street, and James alley, between Monmouth street and Columbia street.

CONTRACTS TO BE LET.

A storm water sewer will be built in Twelfth, Thirteenth, Dale and Seventh streets, Sioux City, Iowa, for which bids will be received until October 10th.

Bids will be received in Cincinnati, Ohio, until October 12th, for constructing sewers in Ernst street, from State avenue to Hiawatha street, and Hiawatha street, from Ernst street to Harrison avenue.

Bids will be received until October 6th for the construction of the following sewers at Altoona, Pa.: Two terra cotta pipe sewers, one on each side of Sixth avenue; one terra cotta pipe sewer along Margaret avenue; one terra cotta pipe sewer along Lexington alley.

Sealed proposals will be received in Buffalo, N. Y., until October 4th, for constructing a 10-inch tile sewer in the north and south sides of Newell avenue, 39, 36, 33 and 30-inch brick sewer in Esser street, 12-inch tile sewer in Pearl street, 12-inch tile sewer in both sides of Glendale place, 15 and 12-inch tile sewer in both sides of Genesee street, 3-foot, 2-foot 9-inch, 2-foot 6-inch brick sewer in Jefferson street, 12-inch tile sewer in Seneca street, 15 and 12-inch tile sewer in Liddel street, 20, 15 and 12-inch tile sewer in Luddington street, and a 12-inch tile sewer in each side of Longnecker street.

CONTRACTS AWARDED.

The contract for the Green street sewer, at Peoria, Ill., was awarded Robert Clark, at his bid of $21,142.90.

Ferguson & Rooney received the contract for the Fifteenth district main sewer, for $8,593, at Scranton, Pa.

The public improvements committee of Kansas City, Mo., awarded a contract for a sewer to George J. Baer, at his bid of $15,953.

The board of public works, Racine, Wis., has awarded contracts for more than ten thousand dollars worth of sewers.

The contract for a sewer in Van Sice avenue and Florence street, Yonkers, N. Y., was awarded Callahan & Reed, for $5,731.

J. M. O'Rourke was awarded the contract, at Denver, Col., for the construction of the Twentieth street storm sewer, for $14,583.98.

Lee & Minahan secured the contract for the West side sewer, to be constructed in Rochester, N. Y. The system will cost $324,000.

The contract for building 6,000 feet of sewers, in Waukesha, Wisconsin, has been awarded David Johnson and Nicholas Devereaux.

The contracts for constructing sewers in Stull, Moore, Plum and John streets, Youngstown, Ohio, were awarded W. S. and G. D. Hersey.

G. H. Bodette was awarded the contract for the construction of a sewer in Oak street, from Earl to Williams street, Toledo, Ohio, for $4,049.

Gray & Temple were the successful bidders for the construction of a sewer in Second avenue, between Twenty-fourth and Twenty-fifth streets, Troy, N. Y.

The council at Homestead, Pa., awarded to Erbeck Brothers contracts for sewers to be constructed: Dickson street, $5,430; Amity street, $15,966, and McClure street, $14,263.

The Cataract Construction Company, of Niagara Falls, awarded the contract for a thirty thousand dollar system of sewers in the Echota district to B. J. Smith, of Rochester, N. Y. The sewer is to be completed within ninety days.

Contracts have been awarded in Saginaw, Mich., as follows: 45 by 67½-inch egg-shaped sewer in Alger street, from Phelon street to Holland avenue, M. McKian, $3,295; 12-inch pipe sewer in Stark street, from State street to Irving avenue, Robert Jacobs, $954.

Work on the system of sewers at Martin's Ferry, Ohio, designed during the summer by Alexander Potter, of New York City, has begun. The contracts for the construction of the Walnut street, Jefferson street and Broadway street sewers have been awarded.

Wilson & Smith, of Saltsbury, Pa., secured the contract for sewer construction in Belle Vernon, Pa., at the following prices: 10-inch pipe sewer, 55 cents; 15-inch pipe sewer, 80 cents; 18-inch pipe sewer $1; 24-inch pipe sewer, $1.60; 30-inch single ring brick, $2; man-holes, $20; inlets, $25.

The contract for the brick-work on the Washington street sewer at Taunton, N. J., has been awarded Hamon & Hopkins. This sewer is 20 by 30 inches, and 350 feet long, and, with man-holes and catch-basins, will cost $549. The contract for excavation for changes to be made in the Main street sewer was awarded Hugh F. McGee.

Contracts for the construction of sewers, Lynn, Mass., have been awarded as follows: Brookline, Parrott, Fayette and Olive streets, John Sheehan, $2,164.60; Autumn street, Arthur Byer, $365.86; Union street, John Sheehan, $101.60; West Neptune street, John Sheehan, $1,498.49; Light street, Arthur Byer, $193.10; Jackson street, Arthur Byer, $193.38; Boston street, John Sheehan, $2,415.90.

WATER-WORKS.

Avon, Ill., has a system of water-works.

The citizens of Amboy, Ill., are making an effort to secure a system of water-works.

A special election will be held October 3, in Lonaconing, Md., to vote on issuing $30,000 worth of water bonds.

A stock company is being organized at Corydon, Ind., for the purpose of constructing a water-works system.

Kingston, N. Y., at a special election on the water question, favored the issue of $600,000 in bonds for new water-works.

A special election held at Barron, Wis., for bonding the city for $46,000 for water-works, resulted in favor of water-works.

An addition is being made to the Ashland Water Company, Ashland, Wis. A Holly pump, with a capacity of four or five million gallons of water per day, will be put in.

The board of water commissioners, in Saginaw, Mich., has determined to abandon the supply from Tittabawassee river, which is believed to be dangerous, and will hereafter use deep well water.

In the report of Chemist Martin, as received by Mayor Gilroy, of New York, recently, giving the analysis of water taken thirty feet above, and thirty and one thousand feet below the plant, after treatment at Brewster's, it was found that the organic matter in the water had been disintegrated into small particles, which settled readily, dangerous nitrites had entirely disappeared, free ammonia had increased at the expense of the albuminoid ammonia, and organic and volatile matter had decreased, while the mineral matter had increased, and the color and odor had improved. Mayor Gilroy asks for $56,000 for the purpose of extending the purifying system.

E. K. Stafford, Boulder, Colo., writes that the city has voted to issue $50,000 in water bonds; $30,000 will be issued December 1, 1893, at 6 per cent. per annum, payable in gold, one-half in fourteen years and one-half in fifteen years.

S. H. Finley, Santa Ana, Cal., writes that the Public Water-works Company of that place recently sunk a ten-inch well, which resulted in a magnificent flow of pure artesian water, at a depth of 320 feet, which, with one previously bored, furnishes water in abundance.

CONTEMPLATED WORK.

Water-works will be constructed at Paw Paw, Mich.

Mannington, W. Va., will have a system of water-works.

Vernon, Ind., is contemplating a system of water-works.

Greenfield, Ind., has voted in favor of a system of water-works.

Newburyport, Mass., voted in favor of a system of water-works.

Stephenville, Texas, is contemplating a system of water-works.

A system of water-works is being discussed at Prattsburg, N. Y.

A water-works system will be built at Sheffield, Ill., at a cost of $6,000.

The citizens of Thorp, Wis., contemplate building a system of water-works.

Lancaster, Ky., contemplates the construction of a system of water-works.

Henrietta, Texas, is contemplating the construction of a system of water-works.

The city council of Brooklyn, Iowa, is contemplating a water-works franchise for the city.

The citizens of Laurel, Md., are contemplating the construction of a system of water-works.

Additional water supply, storage and distributing reservoirs are to be built at Petersburg, Va.

J. F. Wilson writes that the city of Grinnell, Iowa, contemplate putting a pump in their artesian well, 2,000 feet deep, and in the spring they will sell thirty thousand dollars worth of bonds for a system of water-works.

An election was held on August 25th, at Grafton, W. Va., to vote on a system of water-works for the town, which resulted favorably, and $50,000 will be expended on the system. Mr. Alexander Potter was engaged to make the necessary surveys, and prepare plans and specifications, which are now completed, and the work will be let as soon as bonds can be sold.

Chas. S. Magowan, city engineer, Iowa City, Iowa, writes that the city council is contemplating the purchase of the water-works plant from the water-works company.

CONTRACTS TO BE LET.

Bids are advertised for, until October 3d, Hillsboro, Ohio, for $75,000 of water-works bonds.

Bids will be received at Franklin, Ky., until October 2d, for building a system of water-works.

Sealed proposals will be received until October 7th, for the extension of the intake of the city water-works, Burlington, Vt.

CONTRACTS AWARDED.

Robert Baumgarth secured the contract for the West Side sewer, Butte, Mont., for $5,860.

M. P. Kelly, of LaGrange, secured the contract for water-works for Ballinger, Texas, for $14,700.

Shonley Brothers, of Beaver, secured the contract for the new water-works plant at Millvale, Pa., for $63,000.

Chatsworth, Ill., has contracted for a water-works plant for $6,000, to be completed by November 1st.

The contract for 2,900 feet of sewer on Fulton street, Peru, Ill., was awarded A. Hoscheit, at his bid of $1,340.90.

The Barr Pumping Company, of Philadelphia, Pa., was awarded the contract for the new pumping engines at Cincinnati, Ohio.

The Atlantic Works, East Boston, secured the contract for two Manning boilers for the new pumping station at Manchester, N. H., at their bid of $2,100.

The trustees of the village of Canandaigua, N. Y., have awarded the contract for the construction of the East Phoenix street sewer to William Hayton.

J. O. Heaton, Junction City, Kan., was awarded the contract for the erection of a boiler-house and pumping station at West Lafayette, Ind., at his bid of $5,500.

M. J. Blanding writes that the contract for building a reservoir at Galesburg, Ill., has been awarded Bick & Glann. The Rensselaer Manufacturing Company will furnish all valves.

The contract for the 15,000,000 gallon pumping engine to be erected at Pettaconsett station, Providence, R. I., was awarded the Henry P. Worthington Company, of New York.

The water-works trustees of Evansville, Ind., awarded the contract for furnishing two pumps of 3,000,000 gallons each, to the Laidlaw and Dunn Pump Company, of Cincinnati, for $3,000.

The contract for building the system of water-works for Andover, N. Y., was awarded M. P. Birdseye, of Fayetteville, N. Y. Estimates made place the cost of the system, complete, at $16,000.

The contract for a new engine for the water-works at Cumberland, Md., was awarded to the Holly Manufacturing Company. The capacity of the engine will be 4,000,000 gallons, and will cost $17,500.

The board of water commissioners, of Hagerstown, Md., contracted with the Holly Manufacturing Company for a Gaskill pumping engine, with a capacity of four million gallons per day, for $17,500.

BRIDGES.

The Indiana Bridge Company is building a bridge south of Ogden, Ind.

A new iron bridge is being built across the creek near Mt. Clemens, Mich.

A new iron bridge will be built next month across the river at Waukesha, Wis.

A new bridge will be built across the Colorado river at Wharton, Tex., at a cost of $35,000.

The Lafayette Bridge Company was awarded the contract for two bridges near Delphi, Ind.

Bids are invited until October 5 for a deck plate girder bridge, in Delaware avenue, Buffalo, N. Y.

A substantial iron bridge is being constructed over Rountree Branch, south of Platteville, Ill.

The contract for a Howe truss bridge at Santa Cruz, Cal., was awarded Contractor Fitch, for $400.

A large, substantial bridge is under course of construction across the Platte Branch, near Bedford, Ill.

The contract for building the Oak street bridge at New Haven, Conn., was awarded P. Tucker and Brothers for $3,608.

An iron and wood bridge is being constructed over the Alton at Jackson street, Bloomington, Ill., at a cost of $5,000.

A steel bridge, twenty-four feet in length and having four granite piers, will be built at St. Cloud, Minn., at a cost of $40,000.

Sealed proposals will be received until October 3 for building the abutments for a bridge across Cedar Creek, Cottonwood Falls, Kan.

Healy, Tibbett & Co., San Francisco, secured the contract for the construction of a bridge over Tule river, between Porterville and Plano, Cal. The bridge will have three spans, 100 feet long, with cylindrical piers.

A petition has been presented the county commissioners at Pueblo, Colo., for a new bridge across the Arkansas, fifteen miles below Pueblo.

A new steel bridge will be built over the Brazos at Waco, Texas, by the county of McLennan and the city of Waco, which will cost $60,000.

The Buchanan Bridge Company, of Bellefontaine, O., was awarded the contract for the new bridge over Paw Paw creek, La Rue, O.

The new wagon bridge across the bay at Galveston, Texas, is said to be the longest wagon bridge in the world. The cost is estimated at $200,000.

The Fabius tubular iron bridge, which is being constructed at Quincy, Ill., will cost $4,900. The Youngstown Bridge Company furnishes the material.

The contract for a steel and iron bridge across the Ford river, near Escanaba, Mich., was awarded the Milwaukee Bridge and Iron Company, for $2,463.

A wooden arch bridge, 196 feet in length, is being constructed across Grand Canyon, near Livingston, Mont., at a cost of $8,500, and will be completed by October 15.

The cantilever bridge being constructed at Cincinnati will have a sheer span of 1,800 feet, and will be 60 feet wide. It will be the longest cantilever bridge in the world.

A bridge will be built across the Current river, between Van Buren and Chicobee, Mo., by the business men of Van Buren, who have organized and subscribed $3,500 for that purpose.

The board of supervisors, Iowa City, Ia., has ordered a bridge constructed over the Cedar river, in Cedar township, for the purpose of uniting East Cedar and West Cedar townships.

The Berlin Iron Bridge Company was awarded the contract for constructing and erecting the London bridge across the Merrimac river at Concord, N. H. The cost of the bridge will be $17,662.

The board of public works at Kansas City, Mo., has concluded to appoint an expert engineer to superintend the construction of the new Bluff street bridge in that city. The bridge will cost $24,000.

The Indiana Bridge Company, of Muncie, Ind., is constructing a bridge at Chandlerville, Ill., across the Illinois river. The company has a contract for an iron bridge across Lake Fork, near Pulaski, Ill.

The California Bridge Company, of Oakland, Cal., received the contract for constructing a steel bridge over the Rio Tempa, for the government of San Salvador, which will cost nearly $250,000.

Bids will be received until the 9th day of October for constructing a bridge, consisting of a stone or wooden substructure and an iron superstructure, over the Miami and Erie Canal, on Western avenue, in the city of Toledo, O.

The bridge to be built across the Mississippi river at New Orleans will soon be commenced. It is estimated that three years will be required in which to build the bridge, and it will be one of the finest structures in the world when completed.

The contract for the construction of the stone-work of the Milford bridge, between Hamilton and Clermont counties, was awarded McDonough & Willing at their bid of $16,327.50, at a joint meeting held by the commissioners of the two counties, at Cincinnati, Ohio.

The Wrought-Iron Bridge Company, Canton, O., was awarded the contract for the construction of the bridge over White river, at Kentucky avenue, Indianapolis. The plan accepted provides for the construction of the entire bridge, sub-structure and superstructure, at a cost of $60,760.

The Chicago Bridge Company was awarded the contract for constructing a steel bridge in Wheaten township, near Joliet, Ill. The bridge will cost $2,600. A similar bridge in the same township was awarded the Massilon Bridge Company, for $2,400, both bridges to be completed by October 22.

G. B. Gill, Petersburg, Va., writes that an iron bridge is to be built across the Appomattox river, to connect the city of Petersburg and the county of Chesterfield. One-half the cost, which will be from $2,000 to $2,500, will be paid by the city of Petersburg, and one-half will be paid by the county of Chesterfield.

The Gillett-Herzog Manufacturing Company was awarded the contract for a bridge to be constructed across the Yellowstone, at Carter's, Mont. The contract calls for a combination bridge, with iron tubular piers, 222 feet in length, built in one span of 220 feet, 16 feet of roadway and a 16-foot pile approach at each end. The cost will be $7,997.

The bridge recently built at Prophetstown, Ill., consists of two spans of iron-work 155⅝ feet long, two spans of wood-work, one 154⅝ feet and the other 174⅝ feet in length, with a trestle approach at the south end 40 feet long. The four spans rest on three stone piers and two cylindrical piers. Each stone pier contains 120 yards of masonry. The cost of the bridge is $25,979.

STREET LIGHTING.

Bids will be received until October 15th, Pontiac, Ill., for the furnishing of electric lights for five years.

The town council at Greenfield, Ohio, sold, at par, $20,000 of eighteen-year six per cent. electric light bonds.

The city of Santiago, Chili, invites proposals for lighting the streets and squares by electricity, until December 30th. Details can be had at the consular offices of Chiel, at Philadelphia, Boston or Chicago.

N. H. Wilmot, city clerk, Lambertville, N. J., writes that the common council of that city awarded to the Lambertville Electric Light, Heat and Power Company the contract for twenty-four arc lights of 1600 candle-power each, beginning the first of October, 1893.

PUBLIC PARKS.

Shannon, Ill., is making an effort to have a park.

The city park is being improved at Nebraska City, Neb.

The citizens of St. Mary's, Kan., are making united efforts to obtain possession of the old stock-yards to establish a city park.

Ex-Senator Thomas W. Palmer recently offered to deed to the city of Detroit, Mich., the Log Cabin farm for a park, which was accepted.

An effort is being made at Battle Creek, Mich., to purchase Rathburn's grove and convert it into a city park. The grove is situated near the business portion of the city.

Reservoir park, Toronto, Can., has been enlarged by the addition of thirteen acres of ground which the city purchased, and plans for improving and beautifying it are being prepared.

STREET RAILWAYS.

Electric motors were put on the Albright and N street car lines, last month, in South Omaha, Neb.

A company is being organized to revive the project for an electric railway between Indianapolis, Noblesville and Fort Wayne, Ind.

Work has begun on the proposed electric line running from Thirteenth and Franklin streets to Berkeley street, in order to hold the franchise, in San Francisco, Cal.

The Galesburg Electric Motor and Power Company, Galesburg, Ill., is extending its tracks from Cedar street, through Brook, to West street, thence south on West street to the C. B. & Q. R. R. tracks, a distance of one-half mile.

The Taunton Street Railway Company, Taunton, Mass., ran their first electric cars August 31. The work is being rapidly pushed in order to have the whole line of street railway changed into an electric line before October 1.

Horse lines in Indianapolis are rapidly being converted into electric railways. The electric lines are completed and in operation on North Pennsylvania, South Meridian and Union streets, and Columbia and Clifford avenues, and improvements will be made in other lines now.

F. W. Puderer, city clerk, Belleville, Ill., writes that a franchise has been granted the General Electric Company of New York to operate and maintain an electric railroad. The plant is to be one of the finest in the state of Illinois, as only the latest improved machinery and appliances are to be used in the erection and completion of it. The road is to be completed within six months.

MUNICIPAL BONDS.

W. E. Wynne, Avondale, Ohio, asks bids until October 7th, for the purchase of $7,500 of five per cent. sewer bonds.

H. J. Carew, Columbus, Ohio, invites bids until October 9th, for $40,000 of six per cent. street improvement bonds.

Bids will be received until October 5th for the purchase of $50,000 of six per cent. bridge bonds, by H. J. Carew, Columbus, O.

Bids will be received until October 15th, Kalispell, Mont., for the sale of $20,000 of sewer bonds, six per cent. per annum, payable semi-annually.

S. J. Wilkerson, Springfield, Ohio, will receive bids until October 17th, for the purchase of $1,895 of six per cent. street improvement bonds.

C. Angus, Livingston, Mont., invites bids until October 9th, for the purchase of seventy-five thousand dollars' worth of six per cent. coupon bonds.

SEALED PROPOSALS.

WATER-WORKS INTAKE.

Sealed proposals will be received by the Water Commissioners of the City of Burlington, Vt., until October 7, 1893, for the extension of the intake of the city water-works.

The contract will embrace the supplying of all the material and doing all of the work attendant upon the placing of an intake in about twenty-five feet of water on a reef in Lake Champlain, in construction of a pump well in the yard of the station, some seventy-five feet from the lake front, laying, in from ten to twenty feet of water, about two and one-fourth miles of fifty-four-inch cast-iron water pipe with leaded joints connecting the two and connecting the well with the pumps.

Bids must be made on blanks furnished by the city, accompanied by a certified check for $500 as an evidence of good faith, and addressed to the Superintendent of Water-works.

Specifications may be obtained and plans seen at the office of the Superintendent of Water-works.

F. H. CRANDALL, Supt.

NOTICE TO CONTRACTORS—WESTERN AVENUE BRIDGE.

Sealed proposals will be received by the undersigned up to 12 o'clock at noon of Monday, the 9th day of October, 1893, for constructing a bridge consisting of a stone or wooden substructure and an iron superstructure over the Miami and Erie canal on Western avenue in the city of Toledo, Ohio.

All bids must be written with ink, and the price of each item shall be written out in full as well as in figures. Each bid must contain the full name of every person interested in the same. All parties filing bids for the matters specified in this notice must deposit with the City Clerk on each bid the sum of two hundred dollars. All deposits to be in cash or certified check on a bank doing a regular banking business in the city of Toledo, and accompanied by an agreement signed by the bidder and two disinterested persons, guaranteeing that, if the bid is accepted, a contract will be entered into—otherwise the amount deposited to be forfeited to the city; and in case a contract is entered into, said deposit to remain until the first estimate of work done (or double the amount of deposit) is reported to the Common Council.

Bidders will be required to endorse their names on the outside of the envelope containing their proposal, and what the bid is for, the same to be filed with the City Clerk. Bids not filed in accordance with the above requirements will be rejected.

Blank bids and envelopes can be obtained of the undersigned or of the City Civil Engineer.

Bidders must specify the time within which they will commence and complete the work after the acceptance of their bid.

Plans and specifications can be seen at the office of the City Civil Engineer.

The Council reserves the right to reject any or all bids. By order of the Council.

SYLVESTER LAMB, City Clerk.

NOTICE TO BRIDGE CONTRACTORS.

Notice is hereby given that sealed proposals for excavating for and building of abutments for a bridge across Cedar creek, at the Philip Frank crossing, will be received at the County Clerk's office in Cottonwood Falls, Kansas, until Tuesday, October 3, 1893, at 12 o'clock M. Each proposal to be accompanied by a deposit of $50 forfeit. Specifications on file with County Clerk. The board reserves the right to reject any and all bids.

By order of the Board of County Commissioners.

Witness my hand and official seal, this 5th day of September, 1893.

[Seal.] M. K. HARMAN, County Clerk.

CAST-IRON PIPES.

VANCOUVER, B. C.

Tenders will be received by the undersigned up to noon, October 10, 1893, for cast-iron pipes. Specifications may be seen in the office of the City Engineer. Each tender must be accompanied by a marked check or cash deposit equal to 5 per cent. of the amount of the contract. The lowest or any tender not necessarily accepted.

THOS. F. MCGUIGAN, City Clerk.

SEALED PROPOSALS.

NOTICE TO SEWER CONTRACTORS.

DANVILLE, ILL., Sept. 23, 1893.

Sealed proposals will be received by the City Council of the city of Danville, Illinois, up to 4 o'clock P. M., on the 26th day of October, A. D. 1893, for the construction of a brick sewer in said city, of the following dimensions: Length, 5,400 feet; diameter, 3½ to 5 feet; average cut, 5½ feet. Said sewer to be built of two rings of hard burned sewer brick, and in accordance with an ordinance passed and approved August 10, 1893, and in accordance with plans and specifications on file in the office of the City Engineer. Bids shall include the furnishing of all labor and materials necessary to be furnished in order to complete the said sewer ready for use in accordance with such plans and specifications. All bids shall be accompanied by a certified check for $500, to be forfeited to the city as liquidated damages in case the bidder shall fail or refuse to enter into a proper contract with said city and give a good and sufficient bond in the sum of $5,000.00 conditioned according to law for the faithful performance of his said contract. Payments will be made as follows: Part to be raised by general taxation and a part to be raised by special assessment; city's share, about two-fifths, to be paid on estimates as the work progresses; special assessment installments evidenced by $100 bonds bearing 6 per cent. interest.

The city reserves the right to reject any and all bids. Any further information required can be had by inquiring of the undersigned.

E. G. DICKERSON, City Engineer.

Dated this the 23d day of September, A. D. 1893.

STREET IMPROVEMENT.

Sealed proposals will be received at the office of the Street Commissioner, City Hall, until Thursday, October 5 1893, at 4 o'clock P. M., for the following work to be done and material to be furnished:

Grading, curbing and flagging First street, from the north side of South Port avenue to the south side of Trumbull street.

4,000 cubic yards of excavation.

3,200 feet of curb.

12,300 square feet of flagging.

The plans and specifications for the work can be examined at the Street Commissioner's office.

Said proposals must be accompanied by a bond executed by two or more ample and sufficient securities, residents in the county, for at least one-fourth of the sum specified in the proposal for the performance of the work, should the contract be awarded to the person making the proposal, and that if such person or persons omit or refuse to execute such contract, they will pay to the city of Elizabeth any difference between the sum he or they would have been entitled to upon the completion of the contract and that which the city of Elizabeth may be obliged to pay the person by whom the contract may be executed.

The City Council reserves the right to retain all bids which may be offered until opened, and to reject any and all bids for the above work as they may deem best for the interest of the city.

N. K. THOMPSON, Street Commissioner.

Dated Elizabeth, N. J., Sept. 13, 1893.

TERRA COTTA PIPE SEWERS.

ALTOONA, PA.

Sealed proposals will be received by the Committee on Highways and Sewers for the construction of sewers, as follows:

Two Terra Cotta Pipe Sewers to be constructed, one along each side of Sixth avenue, between Twenty-second and Twenty-fourth streets.

One Terra Cotta Pipe Sewer along Margaret avenue, between Seventeenth street and Union avenue.

One Terra Cotta Pipe Sewer along Lexington alley, between First street and Third district sewer.

All bids to be marked "Proposals" and handed or addressed to Thomas McKiernan, chairman of said committee, on or before 6 o'clock P. M., on Friday, 6th of October, 1893. Plans and specifications for said sewers can be seen at the office of the City Engineer, 1201 Seventh avenue. The committee reserves the right to reject any and all bids.

THOMAS MCKIERNAN, Chairman.

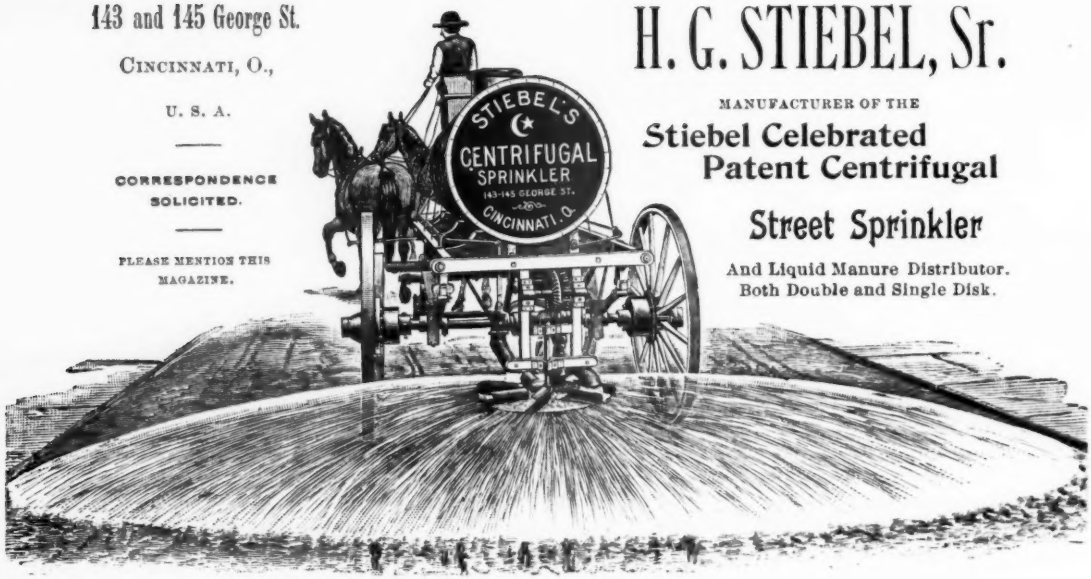
143 and 145 George St.

CINCINNATI, O.,

U. S. A.

CORRESPONDENCE SOLICITED.

PLEASE MENTION THIS MAGAZINE.



H. G. STIEBEL, Sr.

MANUFACTURER OF THE

Stiebel Celebrated Patent Centrifugal Street Sprinkler

And Liquid Manure Distributor. Both Double and Single Disk.

· STIEBEL'S ·

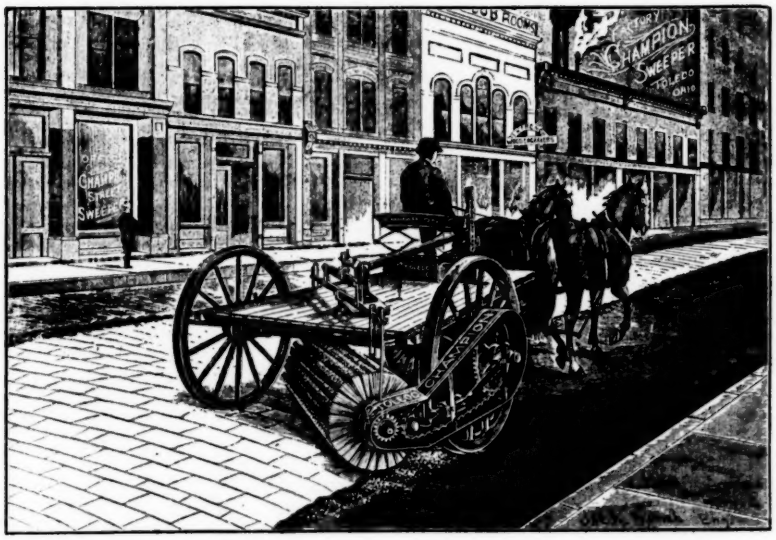
CENTRIFUGAL PATENT SPRINKLER

BOTH DOUBLE AND SINGLE DISCS.

ECONOMY! SIMPLICITY! UTILITY!

In calling the attention of the public to Stiebel's Patent Centrifugal Sprinkler, we wish to emphasize the advantages which it presents as appreciable by skilled as well as unskilled men. As may be seen from the cut, the well known centrifugal power is utilized for distributing the water over the streets uniformly, economically and with the least possible labor. The gearing is of the simplest and most effective construction, strongly built and easily repaired by any blacksmith. By former methods the water carts had to pass up and down the streets three or four times, while in the device presented the attachments may be made to throw the water from 35 to 55 feet—*i. e.*, from curb to curb. In this way the number of carts, horses and wagons needed is reduced 50 per cent. or more, as exemplified in various cities where the Centrifugal Patent Sprinklers have been adopted, and where in one place the number of wagons has been reduced from 41 to 19. The importance of such reduction of constant labor will be recognized by all interested in reducing the expenditures of corporations in this line, and, as a natural consequence, can not but appeal to the minds of all who are working to reduce the taxes under which the people groan. Not only is labor saved, but by the new method there is no more filling up of the holes with water in the streets, and by the equal and uniform distribution more than one-third of the water is saved. In streets narrower than 30 feet one side can be made to do the work, either side or both being capable of complete control. The attachment is adjustable to the wagons now generally in use, so it is apparent that by a slight present outlay many thousands can be saved the public in future. Many testimonials in our possession from those who have had practical acquaintance with this device, and we ask, as we feel entitled to do, that it engage your earnest consideration, for we believe it to be one of the most economical, simple and useful of the machines which this age of inventions has produced.

H. G. STIEBEL, Sr.



To the Hon. the Board of Public Works of the City of Saginaw:

GENTLEMEN—The question of purchasing street sweeping machinery for the eastern highway department, which was brought to your attention some time ago and referred to us to examine and report to you, has been under consideration by us for some time, and we now submit the following for your consideration:

We have examined the cuts and recommendations of six different machines and the testimonials of each from the city officers and municipal authorities of the cities where they are in use, and such other information as could be procured by correspondents, and we are of the opinion that the "Champion" is the best machine, everything considered, for our use.

The merits of the machine briefly are these: It will sweep from two to four inches of mud and street accumulations into windrows with one team of horses at one sweeping. It will sweep equally well on all kinds of pavements in all conditions. The use of steel wire in place of rattan or bass in the broom enables it to sweep equally clean in mud or dust and at a saving of nine tenths of the cost of keeping the brooms in repair.

Yours respectfully,

R. W. ROBERTS, City Engineer.

ALLISON J. MCINTYRE, Sup. of Streets.

At the meeting of the Board of Public Works, held March 18, 1893, the City Engineer was instructed to order "Champion" sweeping machine according to the recommendations hereto annexed.

Very respectfully, ALFRED DAVIS,
Clerk of the Board.

WHAT THE

"Champion" Sweepers Will Do.

Some Facts Worth Knowing.

They will move from 2 to 4 inches of wet mud and street accumulations into windrows, with one team of horses to each machine.

They will clean street car tracks of snow, 3 to 6 inches deep.

They will leave the streets cleaner than the most careful work done by hand, shovels and brooms, at one-tenth the cost of the latter.

They will sweep equally well on asphalt, cedar block, Medina stone, cobble-stone, macadam and brick paving.

One steel Broom will outwear from 10 to 20 of the rattan brooms now in use in other machines.

One Steel Broom, in constant use, will wear from 10 to 14 weeks.

Twenty dollars' worth of steel fibre will wear as long as two hundred dollars worth of the rattan used in other machines.

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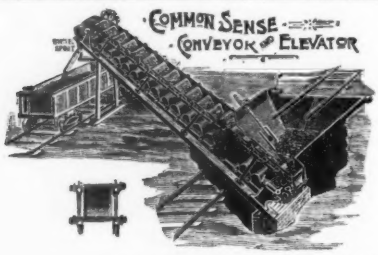

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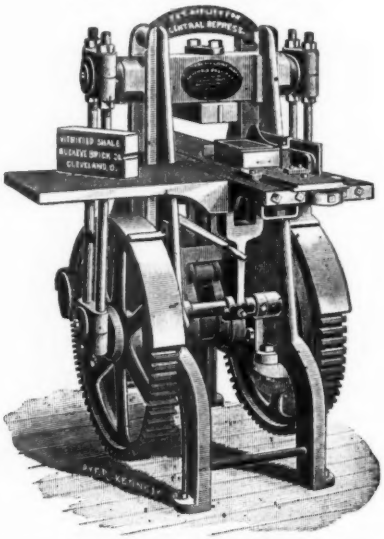

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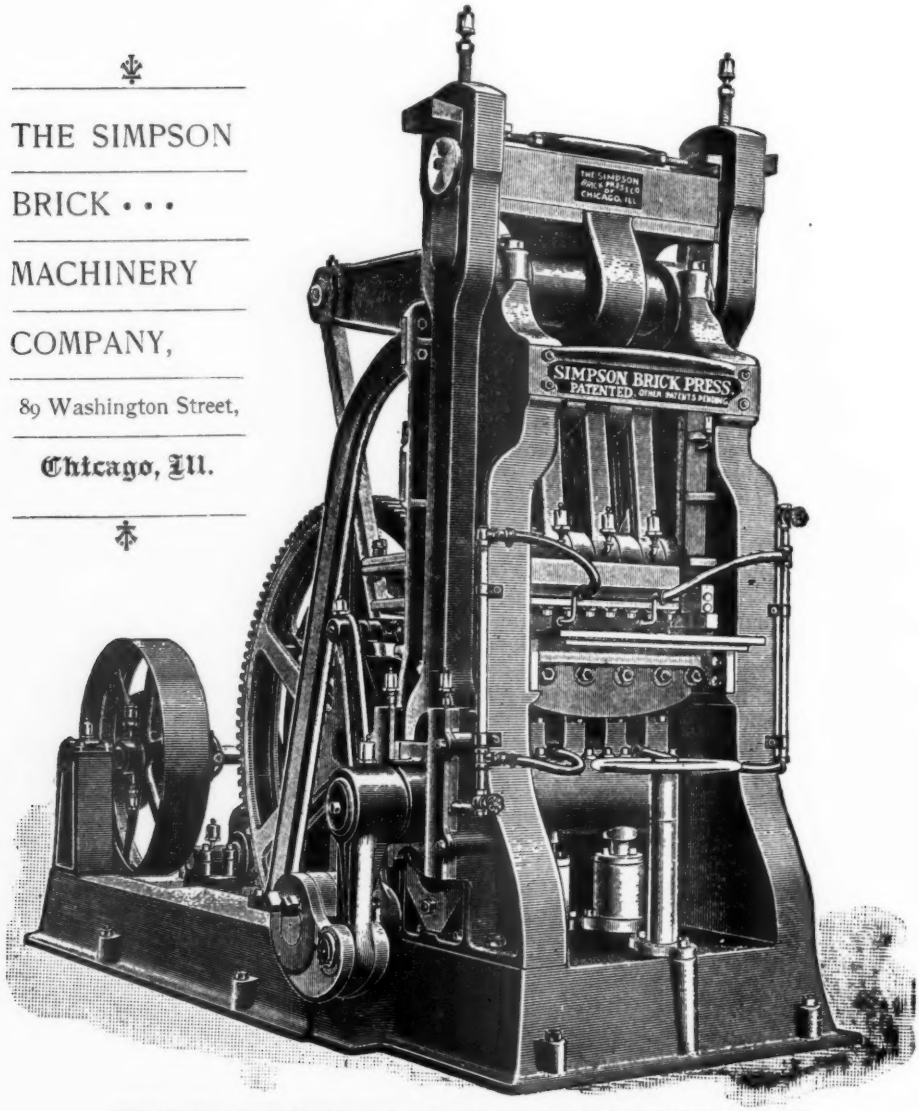

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